

AMD RADEON RETURNS

RX VEGA 56 & 64
FACE OFF AGAINST
EIGHT COMPETITORS!

Oct 2017
Issue 446

YOUR EXPERT

GUIDE TO TODAY'S TECH



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- SECURE YOUR LINUX SYSTEM
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- BUILD A VOICE-CONTROLLED LED LIGHT

LATEST LAPTOPS, GEAR & GADGETS

- RYZEN HITS A NEW LOW... PRICE! \$175 CPU REVIEWED
- 17-INCH GAMING LAPTOPS FROM HP & ORIGIN FACE OFF
- LOGITECH'S WIRELESS-CHARGING GAMING MICE

AMD TEARS INTEL A NEW ONE

- RYZEN THREADRIPPER + X399 MOTHERBOARDS
- EXTENSIVELY TESTED INSIDE:
ARE THESE \$1,000+ CPUs
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Future

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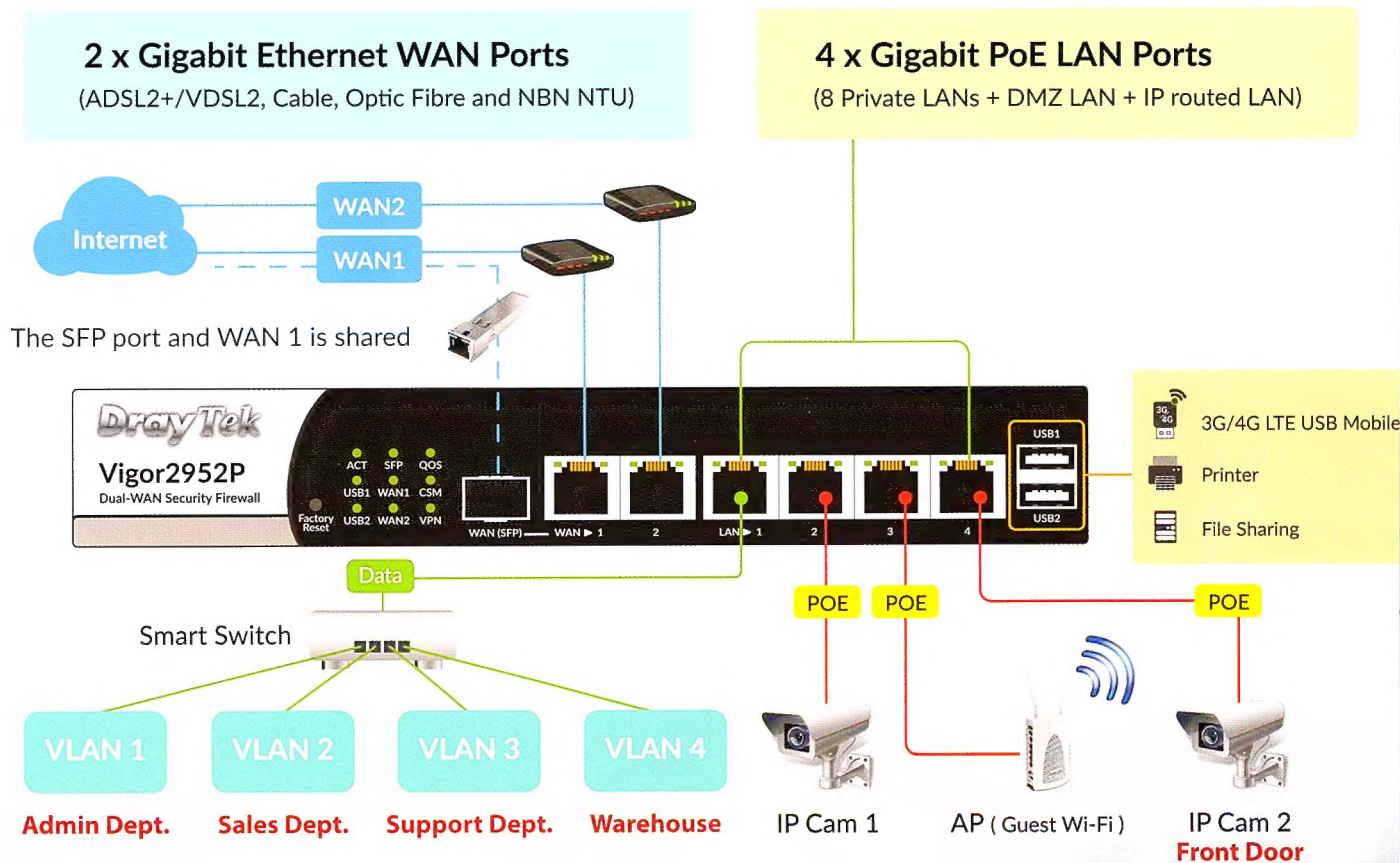
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Aust & NZ

www.draytek.com.au



Application Example:

(A Vigor2952P supports 4 departments with router and PoE functions)



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FIPP

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';--have i been pwned?

Check if you have an account that has been compromised in a data breach

@gmail.com **pwned!**

Oh no — pwned!

Pwned on 5 breached sites and found no pastes (subscribe to search sensitive breaches)

Notify me when I get pwned Donate

Breaches you were pwned in

A "breach" is an incident where a site's data has been illegally accessed by hackers and then released publicly. Review the types of data that were compromised (email addresses, passwords, credit cards etc.) and take appropriate action, such as changing passwords.

- Adobe:** In October 2013, 153 million Adobe accounts were breached with each containing an internal ID, username, email, encrypted password and a password hint in plain text. The password cryptography was poorly done and many were quickly resolved back to plain text. The unencrypted hints also disclosed much about the passwords adding further to the risk that hundreds of millions of Adobe customers already faced.
Compromised data: Email addresses, Password hints, Passwords, Usernames
- CD Projekt RED:** In March 2016, Polish game developer CD Projekt RED suffered a data breach. The hack of their forum led to the exposure of almost 1.9 million accounts along with usernames, email addresses and salted SHA1 passwords.
Compromised data: Email addresses, Passwords, Usernames
- Exploit.in:** In late 2016, a huge list of email address and password pairs appeared in a "combo list" referred to as "Exploit.in". The list contained 593 million unique email addresses, many with multiple different passwords hacked from various online systems. The list was broadly circulated and used for "credential stuffing", not by attackers employ it in an attempt to identify other online systems where the account owner had reused their password. For detailed background on this incident, read Password reuse, credential stuffing and another billion records in Have I been pwned.
Compromised data: Email addresses, Passwords

How to avoid getting hacked

APC's editor reveals his top tips for staying digitally secure.

Protecting yourself in today's digital world is as much about knowing what not to do as it is about having your devices and apps updated and patched. But changing behaviour is more difficult than just installing a security suite on your PC. And sadly, cybercrime isn't going anywhere — we've seen steady increases in criminal activity in the digital world every year since the early '90s.

So what should you do? Well, that's what this month's cover story is for — and it'll teach you how to lock down almost all your devices and services to ensure both your security and privacy... well, as much as is possible in today's age when even government security agencies are the subject of major hacks. But even though there's no such thing as being bulletproof in the age of the cloud, you can be nearly so.

Beyond securing your own gear, though, there are threats you can't easily protect against — all the online services we're constantly signing up for can also be at risk. There's not much you can do to actively shield yourself against third-parties getting hacked, but you can check to see if any of the services you've signed up to have been compromised. Head to the excellent haveibeenpwned.com and you can choose to enter either

a password or an email address to see if either of them can be found on publicly-available lists of exposed user databases. We'd suggest just entering your email address, rather than any passwords. You might be surprised by the results — two of my accounts are on there, and (not to blow my own whistle), you know, if the editor of APC can get inadvertently hacked, anyone can.

Online services and sites being hacked is the key reason as to why you shouldn't ever re-use the same password. If just one of those companies' user databases is hacked and you've been using the same password elsewhere, then you could find that cybercriminals have taken over not just that account, but a whole bunch of others, too.

My last bit of advice, then, is to use a password manager — I'm a fan of LastPass, which went free back in 2015, so there's really no reason not to use it. And you can find a quick guide to getting started with it on pages 52–53 of this issue. ■



DAN GARDINER
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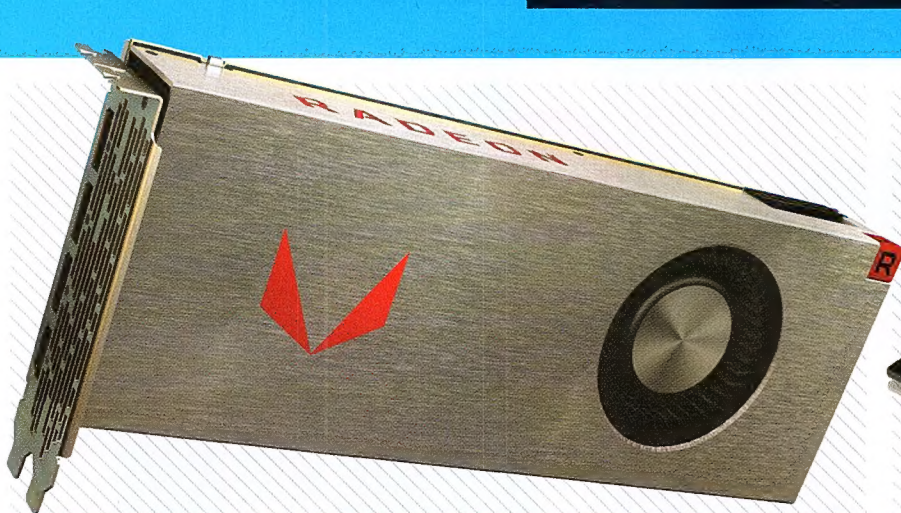
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"Do you need one? Probably not, but people don't strictly need fidget spinners, yet here we are."
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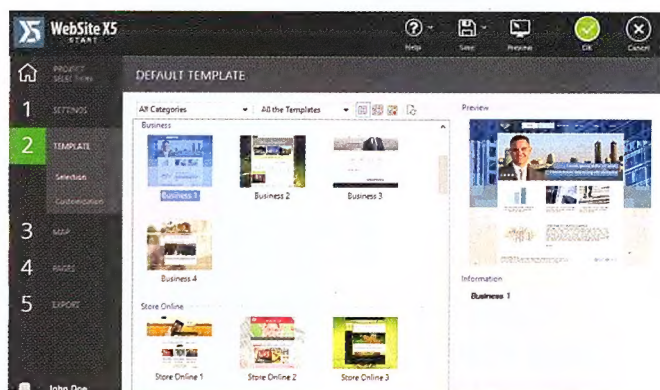
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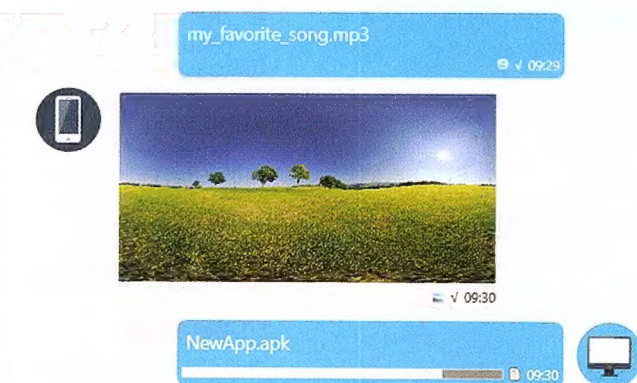
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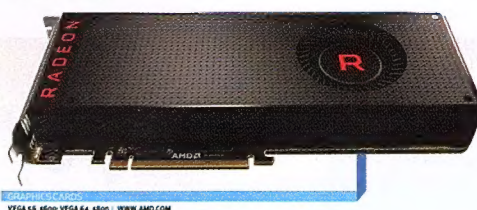
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the lab

» LATEST REVIEWS



AMD Radeon RX Vega 56 & 64

It's been a long time coming, so is AMD's new Vega graphics tech ahead of its time, or just late to the party? Jarred Walton finds out.

It's a bit ironic that the Vega 56 and 64 are what we wanted to see last year, right around the time AMD was busy launching Polaris for the mainstream market. But Vega wasn't even close to being ready. So why did it take so long for AMD to get a high-end replacement for Fiji and the R9 Fury X out the door? AMD has talked about numerous architectural updates that have been made with Vega, and in the professional world, some of those could be massively useful, but so we're APC, we're at least equally interested in how these new cards stack up as a gaming device. So does it?

Let's quickly talk specs. Vega includes 8GB of HBM2 memory in two stacks, which deliver the same 512GB/s bandwidth as the

four stacks of HBM1 in last gen's Fiji, but with just two stacks, the silicon interposer doesn't need to be as large, and HBM2 densities have allowed AMD to double the amount of memory. But AMD isn't just calling this HBM or VRAM. It's now a High-Bandwidth Cache (HBC) and there's also a new High-Bandwidth Cache Controller (HBC2). The difference is important, because the HBC2 plays a much more prominent role in memory accesses. AMD calls this a 'completely new memory hierarchy'. That's probably a bit of hyperbole, but the idea is to better enable the GPU to work with large data sets, which is becoming an increasingly difficult problem.

Vega also has a new geometry pipeline, with over twice the throughput per clock as AMD's previous architecture. The compute

unit has also been improved, with native support for packed FP16 operations, which should prove very useful for machine learning applications. AMD has improved the pixel engine, too, with a new Draw Stream Blending Rasterizer that helps cull pixels that aren't visible in the final scene.

We didn't get the liquid-cooled Vega 64 for testing, but it should be up to 8% faster than the air-cooled version, based on boost clocks. If you look at the raw numbers, Vega holds promise – with higher theoretical computational performance and more memory bandwidth than the GeForce GTX 1080 Ti – but AMD's GCN architecture has traditionally trailed behind Nvidia's GTX 1080, while the Vega 56 is looking to take on the GTX 1070.

Vega 64 runs games fine – more than fine, as it's now the third-fastest consumer graphics card, and we'd

tasks (like cryptocurrency mining) can do very well on AMD architectures. But the power requirements of AMD GPUs have traditionally been higher than the Nvidia equivalents, and that remains true with Vega.

Many in the gaming world were hoping Vega would be able to take down the heavyweight champion, the GTX 1080 Ti. In testing, however, that didn't happen, as the 1080 Ti remains out of reach, though to be fair, it also remains in a higher price bracket. Based on cost alone, the direct competition for the Vega 64 is Nvidia's GTX 1080, while the Vega 56 is looking to take on the GTX 1070.

Vega 64 runs games fine – more than fine, as it's now the third-fastest consumer graphics card, and we'd



Inside APC

Find out all about APC's editorial policies, test practices, how to read the benchmark results and more.

APC is Australia's oldest consumer technology magazine – having been consistently in print for over 35 years, since our first issue way back in May 1980 – and we take that heritage and responsibility very seriously. While our focus is obviously on the personal computer – it's in our name, after all – the very definition of the PC has changed and shifted markedly since the early 1980s. As such, we touch on many other areas of tech too, from smartphones and apps to peripherals, accessories, online services and beyond. We have two main goals: to track down the best of modern tech and also to help our readers make the most of it.

We're also an open church in terms of platforms. We know most people aren't wed to a single brand's products and use a variety of devices. And like you, APC's journalists want to know what's good in tech – no matter what platform it resides on.

INDEPENDENT REVIEWS

Championing technology doesn't mean we're unrelenting yes-men, however, and APC aims to be as objective as possible in all our coverage. That means identifying the best products from multiple perspectives – the best performance, best value and best features and, ideally, the products that offer the best mix of these three.

As a matter of policy, reviews published in APC are not shared with product-makers prior to print. We will contact vendors under certain conditions; for example, if we have a problem testing a product that seems to indicate it may be faulty, or to invite a vendor to clarify how a particular feature works. If an APC reviewer has any potential conflicts of interest involving a brand, the review will always be assigned to another writer.

LABS TESTING

Despite being a small magazine with limited resources, APC still strives to conduct the most rigorous, objective scientific tests and benchmarks we can so as to make our reviews as unbiased as possible. We use a variety of tools and programs for this, including many freely available benchmark suites for assessing media encoding, general system performance, gaming and battery life.

In most cases, for the benchmark results published in APC, you can assume that higher is better. There are certain tests that deviate from this rule and where the opposite is true; in those cases, we've flagged the results with a note explaining as such.

We use both tables and graphs for displaying results; the latter are our preference due to their ease-of-readability, but tables are more compact, so we use these in cases where thoroughness is preferred.

Inventor of 'strong passwords' regrets the advice he first gave

UNIVERSAL PASSWORD, THEN?

The guy who first advised us to come up with strong passwords made up of a complicated combination of letters and weird characters now says he was wrong, 14 years after the fact. Turns out, it's best to have long phrases one would remember as passwords, as most people make predictable changes like swapping numbers for letters or just changing a single number, which most hackers would be able to guess. SS

Not achieving advertised NBN speeds? You could get a refund!

OPTUS FOLLOWS TELSTRA IN REFUNDING NBN CUSTOMERS OVER UNATTAINABLE SPEEDS.

In May, Telstra announced that it had identified customers on the FttN connection who were unable to achieve advertised speeds on their NBN connections and promised them a refund. Optus has now followed suit and says it will reimburse, in part, the cost of the internet package to customers the telco can't deliver high speeds to because of the type of connection. Optus has not revealed how many customers were affected, but said the review process was nationwide. SS

Security researcher who stopped WannaCry accused of writing banking malware

'HERO' ARRESTED IN US, RELEASED ON US\$30,000 BOND.

Marcus Hutchins is better known as the man responsible for helping stop the world's biggest ransomware attack, WannaCry — or at least he was until he got arrested on an unrelated charge of conspiring to create malware that steals banking details. The 23-year-old British security researcher has yet to be released on a US\$30,000 bond (at the time of writing), after pleading guilty to playing a part in the malware's development, sale and distribution. HD



Tech companies aggressively crack down on hate speech

Dropping white supremacists like flies.

Some might think the President of the United States was too soft on the supporters of the 'Unite the Right' rally held in Charlottesville, Virginia, recently, but American tech companies aren't sitting quiet. Big corporations have taken a stance and banned white supremacists and hate groups, or even people suspected to be supporters, from their services or platforms.

Web hosting companies like GoDaddy and Squarespace immediately began dropping domain registrations for alt-right websites like The Daily Stormer, while Facebook removed the event page for the Unite the Right rally, followed by other pages owned by various other hate groups. Uber and Airbnb have banned white supremacist users, Spotify's removed "hate music" from its streaming service and WordPress took down white supremacist blogs. Apple Pay and PayPal also banned sites selling white supremacist merchandise. Even dating site OKCupid had its say by banning a known white supremacist from its platform.

This move has been regarded as controversial, with American free speech proponents claiming it's a violation of the country's First Amendment, curbing everyone's right to the freedom of speech. Sharmishta Sarkar

Scammers posing as NBN reps aiming to steal Aussie identities

CONSUMERS CONNED OUT OF \$28,000 IN EIGHT MONTHS.

Fraudsters pretending to be NBN staff are cold-calling homes to sign unsuspecting consumers up for fake broadband accounts for cheap prices, then asking for sensitive personal information, like names, dates of birth and Medicare numbers, which can be used to access bank accounts and super funds. The Australian consumer watchdog, ACCC, and government organisation Scamwatch have seen a rise in complaints from the public — 316 since January this year — with over \$28,000 scammed from unsuspecting people in the last eight months.

The scammers seem to be targeting retirees and over-65s for the most part, with one of the most common cons being payment for the fake accounts to be made in iTunes gift cards. Another scam involves gaining access to "computers used in a hacking incident", with fraudsters then installing malicious software, stealing personal information, then demanding payment for the so-called service. ACCC Deputy Chair Delia Rickard is warning Australians, especially the over-65s, that NBN Co is a wholesaler and would never contact consumers directly. "If you get an unsolicited call like this, it's a big red flag that you're dealing with a scammer," she said. Sharmishta Sarkar

Microsoft Surface products lose endorsement from major US consumer-rights organisation

STILL RECKONS ITS TABLETS, 2-IN-1S & LAPTOPS ARE FINE.

Although Microsoft's line of Surface laptops and tablets had previously been given the blessings of US consumer-rights organisation Consumer Reports, the nonprofit has retracted its "recommended" label from certain Surface products due to apparent reliability issues after two years of use. Microsoft has said that it "stands firmly behind the quality and reliability of the Surface family", despite reports of unexpected freezing, shutdowns, and unresponsive touch screens. HD

Facebook is now the world's most-loved brand, apparently

AS MUCH AS ANYONE CAN TRULY LOVE A BRAND...

US-based social analytics company NetBase has conducted its third Top 100 Global Brand Love List, and this year, lil' ol' Facebook has apparently taken home the crown. The survey used NetBase's patented algorithms on data obtained by looking at "brand conversations across the social web" for a little over a year, and it found Zuckerberg's social giant was closely followed by Amazon, eBay, Apple and Snap in the amount of directional love they received. We're sure marketing teams everywhere threw wild parties to celebrate. HD

Hackers at DEF CON break into US voting system computers in minutes

HACKERS FIND UNENCRYPTED PERSONAL INFORMATION.

As part of the DEF CON cybersecurity conference recently held in Las Vegas, organisers acquired 30 voting machines (currently used throughout the US electoral system) for its attendees to attempt to hack — every one of them was, and fast. The exercise was intended to demonstrate the need for tighter voting machine security, a point that was made with real conviction when one of the machines offered up the personal information and voting preferences of over 650,000 Americans. HD



Foxtel adds another 128 torrent and streaming sites to its hit list

Aussie pay-TV giant not playing games with pirates.

After having successfully lobbied to have all major Australian ISPs block access to selected piracy sites back in December 2016 (specifically The Pirate Bay, Torrentz, TorrentHound, IsoHunt and SolarMovie), Foxtel and other local movie and TV rightsholders have been adding dozens of additional sites to their list of claimed infringers.

But as of August, the pay TV company has taken aim at an even bigger swathe of sites, targeting another 128 domains it says are linked to piracy. Some of the sites in the crosshairs include Putlocker, Watch TV Series, 1337x, CartoonHD, YesMovies, Watch Episodes and many more, including secondary mirrors and proxies of those key sites.

The timing of this most recent court hearing lines up quite neatly with Foxtel's airing of the latest season of *Game of Thrones*, a show the presiding judge Justice Burley confesses to be a fan of.

A good portion of the targeted domains are streaming sites, rather than the more traditional torrent aggregators. Justice Burley has described the somewhat futile attempts at blocking these sites along with their affiliated domains as something like "whack-a-mole". Harry Domanski

Elon Musk and army of AI experts again call for autonomous-weaponry ban

HOPES TO PREVENT ROBOTS FROM PULLING TRIGGERS WITHOUT HUMAN SUPERVISION.

Two years ago, Elon Musk — along with over 1,000 AI experts and tech-company executives — signed an open letter to the UN pleading for the ban of "offensive autonomous weapons". Among those names were professor Stephen Hawking, Google DeepMind CEO Demis Hassabis and Apple co-founder Steve Wozniak. In August, Musk renewed his appeal, and has roped in more tech bigwigs, including Mustafa Suleyman (of Alphabet, Google's parent company) along with a multinational team of 116 specialists in order to reinvigorate the fight, with the group penning another open letter that hopes to further the cause. The timing of the letter falls ahead of the UN's formal discussions on the issue, and comes from a team that represents "companies building the technologies [...] that may be repurposed to develop autonomous weapons". There are a number of high-profile figures and specialists in the field on both sides of the AI debate, and several have called out Musk on his alleged alarmism in the past. Notably, his feud with Mark Zuckerberg garnered some attention and provoked responses from a few distinguished experts who claimed that he was distorting the debate. Harry Domanski

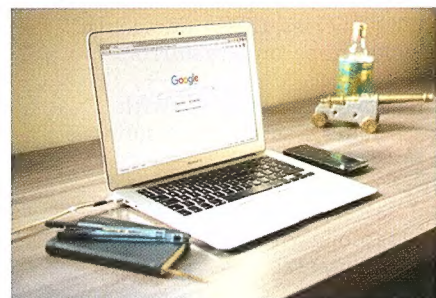
numbercrunch

» HARRY DOMANSKI LOOKS AT THE NUMBERS DRIVING THE BIG TECH NEWS



AMOUNT OF CURRENT NBN CONNECTIONS THAT AREN'T ABLE TO EVEN HIT 25MBPS

The latest report on the NBN's rollout suggests that 6% of the service's Fibre to the Node (FttN) customers aren't able to reach speeds of 25Mbps (even if they were to pay for a higher-tier service) while only 32% could possibly benefit from the highest tier, which offers speeds of 75–100Mbps. The company has suggested that a significant factor in this is the "coexistence" of ADSL connections on the copper wiring that forms part of FttN services, and that these ADSL services will likely remain active until mid-2022.



1.3x

HOW MUCH MORE VALUABLE GOOGLE IS COMPARED TO FACEBOOK (BUT THE GAP IS CLOSING)

As it currently stands, the value of Facebook is US\$497 billion according to data analyst company S&P Capital IQ, however Google is sitting at US\$645 billion. This equates to Google being 1.3 times more valuable than the social media giant, whereas five years ago, Facebook was only worth a sixth of Google. While Google has always held a lead over the Facebook, the gap between the two has been steadily closing as they race towards becoming the first trillion-dollar company.



91%

HOW MANY IT-SECURITY PROFESSIONALS THINK GOVERNMENT-MANDATED BACKDOORS WOULD BE EXPLOITED

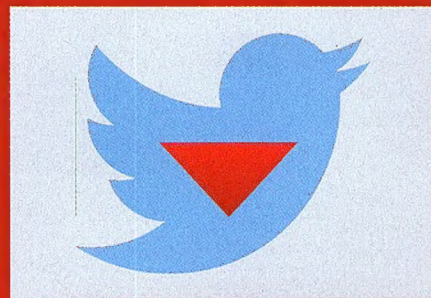
According to a survey conducted by security company VenaFi, 91% of IT-security professionals believe that cybercriminals would take advantage of backdoors that are built into messaging services utilising end-to-end encryption, if the Australian Gov's plans come to pass. Furthermore, 72% of the surveyed experts didn't believe that this new action would even improve the nation's safety against the terrorists and "bad actors" that Malcolm Turnbull intends to defend against.



\$2.3 million

AMOUNT OF MONEY RAKED-IN IN A SCAM BY AN AUSTRALIAN DOMAIN REGISTRAR COMPANY

Two Australian domain-name registrars that are managed by the same director have been accused of scamming \$2.3 million out of their customers. Using false invoices, Domain Name Corp and Domain Name Agency would ask their customers — typically businesses — to pay a sum of money around the \$250 mark so they could renew their domain name. In reality, the invoices were to register brand-new domains that were sneakily similar to the businesses' existing names, thus they would often be paid without much consideration.



US\$6 billion

AMOUNT OF VALUE AMAZON'S SHARES LOST AFTER A SINGLE TWEET FROM DONALD TRUMP

Donald Trump recently tweeted that "Amazon is doing great damage to tax paying retailers", and within minutes, the company's shares had plummeted in value by a total of US\$6 billion. The tweet seems to be in retaliation to an ongoing feud with *The Washington Post* — which is also owned by Jeff Bezos, the CEO of Amazon — and, in particular, an editorial that admonishes President Trump's response to the White Supremacist protests and counter-protests that took place in Charlottesville in August this year. ■

tech**brief**

» CARMEL SEALEY WADES INTO A CURRENT NEWS TOPIC TO TAKE A CLOSER LOOK

'With data suggesting that approximately 94% of road accidents occur due to human error, the prospect of handing the reins over to a more capable — and statistically safer — AI driver is very tempting'



Taking your hands off the wheel

No longer the realm of science-fiction, driverless cars are making leaps and bounds — and they're almost actually here!

For your humble writer, the concept of autonomous vehicles was — for a long time — nothing more than an image of Kryten from *Red Dwarf* engaging autopilot in the Starbug, only to then hear AI Holly complaining about how there's no such thing and that it's actually her doing all the work. Far from being a thing of the distant future, however, fully legal driverless cars could be here as soon as 2021, according to Tesla CEO (and world saviour) Elon Musk. With data suggesting that approximately 94% of road accidents occur due to human error, the prospect of handing the reins over to a more capable — and statistically safer — AI driver is very tempting to many. But before we reach that 2021 milestone, there are a few things that first need to be established and/or ironed out, including the reliability of the tech, the laws surrounding its use and determining how the AI should react in accident situations — for instance, deciding between the lives of nearby pedestrians and the passengers in the car. Whatever the timeline, however, autonomous vehicles are definitely en route.

NSW and Victoria to host driverless vehicle trials

Many countries around the world have already commenced testing of autonomous vehicles, and Australia has joined the list with the cooperation of Tesla, BMW, Volvo and Mercedes-Benz. While South Australia already participated in trials in 2015, these new tests will be conducted amongst regular traffic users, with a two-year trial set to take place at Sydney Olympic Park, where a small shuttle service capped to a sedate 10km/h will follow a pre-programmed track.

Researcher disguises himself as a car seat to test new interaction method

That's not something you read everyday, but all in the name of science, right? This US researcher was spotted testing out an "external communication" method, namely a band of lights on the windscreen, which is being trialled as a potential replacement for the cues pedestrians and other motorists receive from having a person in the driver's seat (for example, hand gestures for 'After you' or 'Thank you').



India to ban driverless cars to protect jobs

India's transport and highways minister Nitin Gadkari has stated recently that, if he has anything to do with it, the country "won't allow driverless cars". However, rather than coming from a safety standpoint — although introducing driverless cars in India would be quite the challenge — Gadkari is more concerned about the professional drivers who would lose their jobs should autonomous vehicles become widespread across the country.

Licences a thing of the past?

Of course, with new technology comes new laws, and one of the things lawmakers will have to figure out is whether or not being in an autonomous vehicle means you no longer have to know how to drive it yourself. Imagine being able to hire a truck without needing a truck licence, for example. While manufacturers still require there to be a human backup driver present (just in case), will a mere basic understanding of where the brake pedal is be all that is required to 'drive' in future?

Driverless cars: opening doors to the young and disabled

Just as non-licence holders could potentially still get behind the wheel, the future of autonomous vehicles also provides immeasurable opportunities for others. Very soon, unsupervised minors, the disabled, those who suffer illnesses or conditions that prevent them from being allowed to drive, and even the blind could enjoy the benefits of getting from A to B in their own car without having to rely on others — not to mention allowing you to get home after a long night out down the pub! ■

gadgets

» GEAR WE WANT

ALL CONTROLLER

The one controller to rule all your devices.

CA\$65 | WWW.ALL-CONTROLLER.COM

If you like to game on more than one type of device, you're likely to have discovered that you need a whole slew of game controllers to support them. The ALL hopes to change that by offering compatibility for iOS, Android, Windows, Mac, Linux, Apple TV, Android TV, PS3 & 4, Xbox 360 & One, retro systems and Nintendo's Wii, Wii U and Switch consoles – in other words, this ambitious Kickstarter project is promising a lot. Adding even more appeal, the ALL Controller has fully customisable button mapping and sensitivity controls, a built-in smartphone cradle for gaming on the go and even the ability to connect to drones. **JB**



RED HYDROGEN ONE

Adding another element to the smartphone.

FROM US\$1,195 | WWW.RED.COM/HYDROGEN

Cinematic camera company Red has played a considerable role in the transition of movies from film to digital formats over the past decade, and it's recently turned that technological prowess to the smartphone market, announcing a new phone dubbed the Hydrogen One. The key selling point of this promising unit is that it'll have a holographic projector, allowing you to convert videos (and hopefully games) into shareable Star Wars-style holograms. Naturally, the company will draw on its extensive camera technology and software to give the Hydrogen One some special selfie specs as well. **JB**

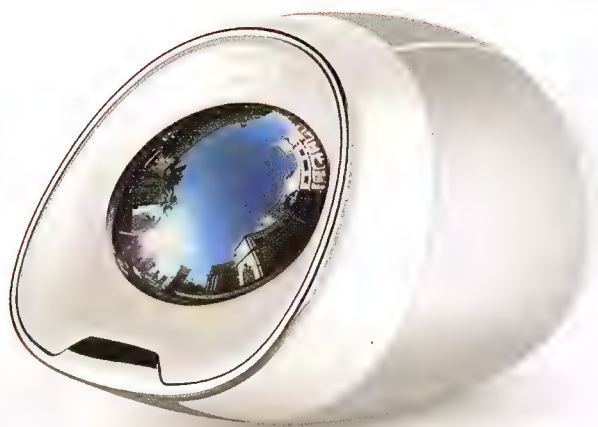
AVIONICS V1 EBIKE

This low rider can really fly.

\$TBC | WWW.AVIONICS.BIKE

Looking like a steampunk pastiche of modern minimalism and industrial craftsmanship, this aerodynamic electric bicycle can push you along at speeds up to 58km/h, no matter how heavily laden with style it is. The slick V1 electric bike will be the first crowdfunding campaign from the Poland-based startup Avionics, so there's always the risk that the appeal of this wood-trimmed electric bike will only be skin deep. But if the 120km range, 'brake energy recuperation' tech and 203mm rear disc brakes make it onto the finished product like Avionics is claiming, then the V1 could be as cool as the Batpod. **JB**





TAMAGGO 360LIVECAM

Enjoy your most memorable moments.

£332.50 | TAMAGGO.COM

Yes, it looks like a big metallic egg, but you'll find no yolks here, only a palm-sized Bluetooth-connected camera designed to shoot 360° stills and videos of your life – from travel adventures and life events, to parties, gigs and gatherings – ready to be shared with the world. It's easy to use, with an integrated 1.5-inch LCD touchscreen, so you can start shooting, then reviewing your footage instantly. Alternatively, you can control the camera remotely using the iOS and Android-friendly app. Plus, invest in a pair of Homido VR goggles from the Tamaggo online store, slide your smartphone inside and relive your memories over and over in complete immersion!

SUUNTO SPARTAN TRAINER WRIST HR

This is Sparta...n Trainer!

£319 | FOSSIL.COM

The outdoor-loving smartwatch brand for fitness fanatics is back with a new addition to its prestigious Spartan line, the Suunto Spartan Trainer Wrist HR. This gorgeous 24/7 GPS sport smartwatch is smaller, lighter and more affordable than anything you've seen before in the Spartan range. The successor to the Suunto Spartan Sport Wrist HR, the Trainer features the same high-performing heart-rate monitoring tech, measuring blood flow at the wrist. It's capable of tracking 80 different sports, including running, swimming and cycling, and uses GPS to track speed, distance covered, pace and the altitude of whatever trail you're on. It has up to 10 hours of battery life with GPS switched on, but use it in power-saving mode and it stretches out to 30 hours. Disable all smart tracking and it may give you 14 days of wear before needing more juice.



ASUS ZENFONE AR

Interact with virtual objects with this new phone!

£799.99 (AU PRICING & AVAILABILITY TBC) | ASUS.COM

The ZenFone AR is the first smartphone certified for Google Tango (AR) and Daydream (VR), so if you want to experience mobile VR/AR, this is your way in – although, you'll have to pay a premium. Google Tango and Daydream platforms come fully supported on the ZenFone AR, but to enjoy the full experience, you'll need a Google Daydream View headset. The biggest AR/VR-focused innovation on this phone is the Super AMOLED screen designed with an ultra-low-persistence mode to stop the impression of motion blur. That, and the Tri-Cam System fitted at the back. Yes, three: there's a 23MP main rear camera, flanked by a motion-tracking one and a depth-sensing cam, too. Away from AR/VR needs, there's an 8MP camera at the front, with optical image stabilisation for good low-light photo quality, plus a range of modes including Super Resolution, which merges several exposures to create a 92MP image. ■



how it's done



Microsoft Surface Laptop

Going under the hood of Microsoft's first laptop.

Teardown is the word of the day, and we're diving into Microsoft's new Surface Laptop right now. Will this carpeted Alcantara-clad laptop excel in our teardown room? The power is in our hands.

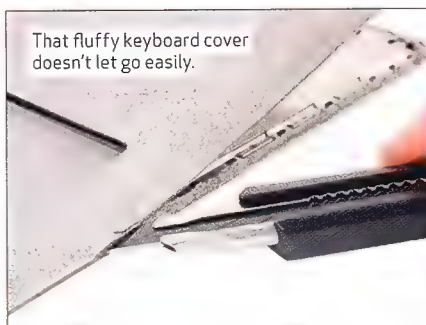
MAJOR TECH SPECS:

- 13.5-inch IPS PixelSense display, 2,256 x 1,504 resolution (201ppi)
- Intel Kaby Lake Core i5 (3M Cache, up to 3.1GHz) or Core i7 (4M Cache, 4.0GHz) CPU
- 4GB, 8GB or 16GB RAM
- 128GB, 256GB or 512GB PCIe SSD storage
- 720p front-facing camera with Windows Hello sign-in
- USB 3.0, Mini DisplayPort and SurfaceConnect charging port
- 802.11ac Wi-Fi, IEEE 802.11 a/b/g/n compatible, Bluetooth 4.0

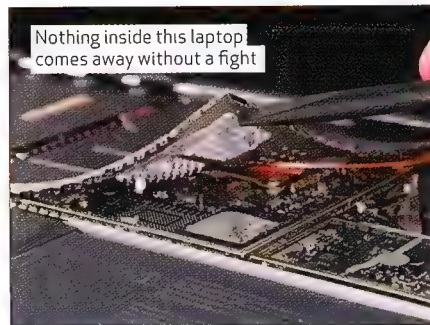
KEY FINDINGS:

- We take a peek under the suspicious rubber footpads on the bottom of the laptop, but find metal feet instead of the screws we were hoping for. Looks like we have to peel up that (dubiously luxurious) Alcantara after all. Jimmy in hand, we start popping clips and peeling adhesive. Already, this doesn't feel like it'll go back together. We try to remove the fabric cover, but the

That fluffy keyboard cover doesn't let go easily.



Nothing inside this laptop comes away without a fight



going gets a lot tougher south of the keyboard. We have to pull out the knife now, to cut off the rest of the pelt. Layered underneath, we find a metal shield – the meat in our Surface sandwich.

- With more adhesive and plastic bits holding the shield from beneath, we fire up the iOpener. Now we have a clear look at the plastic, it seems these aren't reusable clips at all, but weak ultrasonic spot welds that we've been busting through. This is definitely not going back together without a roll of duct tape.
- With the keyboard plate finally wrestled free, we're at least pleased to see the long cable connecting it to the body. However, our pleasure is short-lived: The connector is trapped under a clip-on shield on the motherboard. With the

keyboard out, we begin the search for the trackpad, and find it trapped under tape and a metal shield, but it's nothing we haven't handled before.

- We look for a battery connector to dispatch, but it's nowhere to be seen. Looks like we're doing this live! The Surface Laptop packs a 45.2Wh battery, roughly the same capacity as the latest Surface Pro (45Wh), and more than the iPad Pro 10.5-inch (31Wh) and latest MacBook Retina 41Wh).
- Also visible is a secondary heat pipe, helping dissipate heat from both sides of the motherboard. The modular headphone jack is free to go, contacts and all. No Surface product is complete without a hinge, but these feel a little pedestrian. With that, the display is unhinged.
- **Repairability Score:** 0 out of 10 (10 is the easiest to repair). You can't get inside without inflicting a lot of damage. The CPU, RAM and onboard storage are soldered to the motherboard, making upgrades a no-go. The headphone jack can only be accessed by removing the heat sink, fan, display, and mobo. The battery is difficult and dangerous to replace, giving the device a limited lifespan. ■

About iFixit

iFixit is a global community of tinkerers dedicated to helping people fix things through free online repair manuals and teardowns. iFixit believes that everyone has the right to maintain and repair their own products. To learn more, visit: www.ifixit.com

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(Optional)



Per-Key RGB Backlit
Keyboard



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USB 3.1



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Gen. 3 SSD



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Up to 32GB



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Rapid & Massive
(Optional)

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MADE in TAIWAN

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www.gigabyte.com

epinions



"To get a decent signal to stream Netflix in the bedroom, a distance of only 15m, I've had to set up an old Netgear router connected via Ethernet cable."

DISAPPOINTED BY ISP-SUPPLIED NBN ROUTER

So I finally got connected to the NBN a few weeks ago. I decided to stay with my old ISP and I already had cable internet, so I'm now getting my NBN via HFC. While I'm so far very happy with the speeds (80-100Mbps down and 35-40Mbps up, even at 8pm) my main gripe is with the ISP-supplied Sagemcom F@st 3864AC modem. For a modem with 2.4 and 5GHz, the power of its wireless signal is pathetic, so much so that, to get a decent signal to stream Netflix in the bedroom, a distance of only 15m, I've had to set up an old Netgear router connected via Ethernet cable to extend the signal.

But that's not the worst thing about the Sagemcom F@st 3864AC – that mantle goes to the fact that a max of only 16 devices can connect via Wi-Fi at any given time. In a family of four with multiple wireless devices, along with all the other hardware like TVs and so on, 16 connections is simply not enough – such a low maximum is, frankly, pitiful in such a connected world. Hopefully, there will be some sort

of firmware upgrade that will increase the amount of devices that can connect at any given time.

Craig Bennett

Ed replies: *Underwhelming ISP-supplied routers have, sadly, been a common consumer gripe for many a year. So while it's a little disappointing that this is still the case with the NBN, it's not too surprising. On the plus side, there's a shedload of good options out there now, and if you need good wireless performance in more far-flung locations, then the mesh routers that our sister mag TechLife has reviewed in this month's issue (see issue 68, page 64) might be worth a good look.*

COMPETITION AGAIN, AT LAST

As a long-time APC reader, I thought I'd write to give my two cents about what has, for me at least, been one of the most unexpected (and welcome) developments of 2017 – the sudden return of the high-end desktop CPU battle.

It seems like Intel's practically owned the space for the better part of a

decade now, ever since it introduced its Core i chips back in 2009 – something which seems to have contributed to the stagnation we've seen when it comes to CPU clock speeds and core counts.

Now that AMD is back with something competitive in Ryzen (if not quite in every area – gaming still seems to be one spot where Intel comes out ahead, albeit just), Intel's suddenly announced it's releasing six-core CPUs for the consumer market as part of its new 8th-generation Core i series... Talk about things that make you go 'Hmm...!'

I guess it's an important reminder of how critical competition is for the health of the tech industry in general, but it does make me wonder about other areas of tech where single companies dominate. Why is there no one to take on Facebook when it comes to social platforms, for example, or Google when it comes to... well, everything else on the web!

Peter Brunner

APCMAG@FUTURENET.COM

Come on, have your say!

We want to hear what you think. Add to these discussions or email your views (in fewer than 250 words) to apcmag@futurenet.com. All correspondence becomes the property of APC and is subject to editing. Letters must include full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

Tech not as green as it seems

Shaun Prescott rifles through a report suggesting tech giants aren't as environmentally friendly as they say.

One of the most insidious tricks in the corporate PR book is the appearance of being environmentally friendly, because although well-meaning consumer habits can't possibly help neutralise the climate havoc wreaked by political foot-dragging, we'd like to think it can! So, naturally, companies like to tout their green friendliness. But according to a report by the Repair Association – an organisation that roots for the dialing back of planned obsolescence, among other things – many tech giants are all talk and no(t enough) action.

And it's planned obsolescence and repairs where most companies seem to be lax. It doesn't help that, as the report observes, many manufacturers actually hold positions on green electronics standards boards – leading to a lot of fairly self-interested standard-setting. According to Repair executive director Gay Gordon-Byrne, this has actually lead to these 'standards' working in the favour of manufacturers via "warping them into a tool that drives sales at the expense of the environment."

As electronics is such a rapidly evolving industry, these standards tend to lag behind what would be required to make any meaningful difference to the sustainability of manufacturing. According to the report, where one facet of a phone might move in a sustainable direction (such as the energy efficiency of a battery), it'll often be cancelled out by using more difficult-to-recycle materials. As anyone who's ever tried to keep up with the smartphone industry can no doubt attest, these devices aren't exactly built to last, either.

"Unfortunately, manufacturers have consistently opposed stronger reuse and repair criteria. And though manufacturers often claim they design for durability, no durability criteria is included in US electronics standards. As a result, green standards have systemically failed to incorporate strong policies that would enable repair, reuse, and product life extension for electronics."

The report advocates for better lifespans for electronics, ideally through removing any resistance to repairs, designing goods to disassemble

easier, and providing better availability of service documentation. It also advocates for more modular design, presumably so that components can be used across various types of model.

But typically – although manufacturers and corporations like to tout their green credentials – the industry as a whole isn't doing much to change the status quo.

"With manufacturers standing in the way, it takes years to pass even weak standards," the report's rather dire conclusion reads. "There is little room for negotiation and scant opportunity for progress. It's time for oversight groups or regulatory bodies to step in and re-craft the development process. No single group should be able to control voting and water down the standards."

The Repair Association doesn't name any companies in its report, but neither does it pull any punches in its closing gambit: "[standards boards] have become a complicated way for manufacturers to greenwash products that have a devastating environmental impact and pat themselves on the back for [doing] business as usual". ■

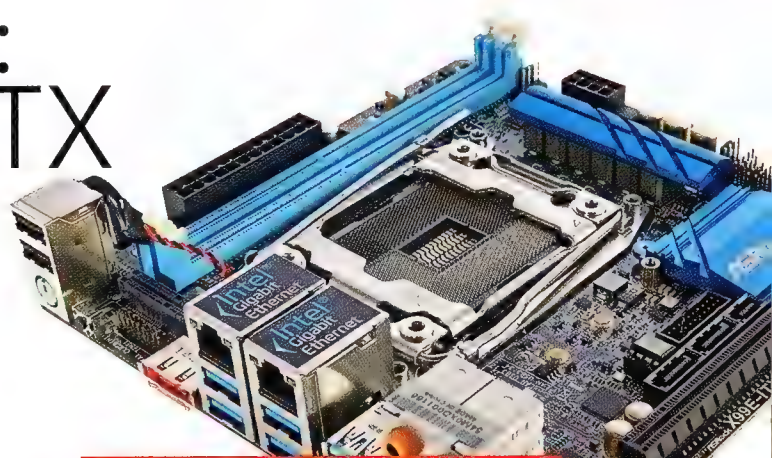
END USER

Share your stories!

If you have an interesting story about technology users, their experiences and the issues that affect us all (whether funny or serious), email us at apcmag@futurenet.com. All correspondence becomes the property of APC and is subject to editing. Letters must include writer's full name, street address, suburb, state and phone number to be considered for print publication. Address and phone details will not be published.

Head to head: Mini-ITX vs ATX

In this regular monthly feature, Alan Dexter pits two competing techs in a head-to-head battle to decide which one is superior.



"When it comes to raw performance, there's pretty much nothing you can do in a larger case that you can't do in a well-designed compact chassis."

One of the attractions of PCs is that they come in all shapes and sizes, and you can build whatever system you want. Some love a full ATX system, while others only ever consider a compact Mini-ITX build. While there have been plenty of form factors over the years, there are four common ones these days: ATX, Mini-ITX, microATX and Extended ATX (something of a niche). Of these, the battle generally comes down to a choice between ATX and Mini-ITX, but what are their benefits? Which should you use for your next build? Allow us to help.

Round 1

PERFORMANCE

The general perception for a long time was that, if you wanted serious performance, you needed a full-sized motherboard and a sizeable full-tower case to put it in. Because, you know, size matters. An obvious win for the bigger formats, then? Not quite.

The thing is, the world has changed, and as more and more silicon is squeezed into the CPU packaging itself, you're losing out less when it comes to dropping down from an ATX to a Mini-ITX or microATX form factor. In fact, when it comes to the core functionality, about the only thing you can lose is support for SLI, because Mini-ITX only boasts a single PCIe slot.

That consideration aside, most Mini-ITX motherboards boast feature sets that are comparable to their ATX siblings, and when it comes to raw performance, there's pretty much nothing you can do in a larger case that you can't do in a well-designed compact chassis. Planning on water-cooling your CPU? Plenty of the cases we look at in these pages support 240mm radiators, and we always consider them in that light, so you'll be able to overclock your CPUs just as much as you can in a larger case.

Round 2

EXPANSION

What do you really need in your PC? Once you've got your motherboard, CPU, memory, graphics card, PSU and storage in place; what other components do you actually need to make it do what you want? The days of needing soundcards, network interface cards, SCSI boards and various other goodies are thankfully long behind us, and while there may be specific instances when you need to reach for such hardware, your motherboard does it all.

The reason we're talking about expansion is because it's the main differentiator between the form factors. ATX can, in theory, squeeze up to seven expansion slots into its 12 x 9.6-inch space (realistically, E-ATX is a better option if you need all seven), while the 6.7 x 6.7-inch Mini-ITX boasts a single slot; microATX offers a maximum of four, with SLI/CrossFire a possibility.

Storage is another consideration: Mini-ITX boards tend to have fewer SATA ports, often as few as four, while ATX can easily hit 10. Obviously, smaller cases don't have room for so many drives, either. So, ultimately, we have to give this one to the bigger form factor, although whether you actually need so much room is another matter.

Round 3

COMPACTNESS

Your choice of motherboard doesn't necessarily have to dictate your chassis. If you want to slot a microATX motherboard into a full ATX case, you can. It's the same story for Mini-ITX motherboards as well, because the four mounting screws are compatible with all modern cases (older cases may not be compatible, though, so that's worth bearing in mind). Obviously, you can't ease an ATX motherboard into a case designed for Mini-ITX, unless it happens to be a TARDIS, but generally, you have plenty of options for how you marry up case and motherboard.

The point is: You can still build a huge system even if you decide to go down the Mini-ITX route, but with the advantage that you can actually build a much smaller machine, should that be a requirement.

And space can often be a defining factor for new builds, particularly if you want the final machine to sit on the top of your desk, rather than be hidden underneath it. A compact build, with a dash of water cooling, can make for a beautiful thing — an important factor for more and more of us nowadays. Which means that, if space is a factor, then it's hard to go too wrong with Mini-ITX.

TIE:

Mini-ITX, ATX, microATX, Extended ATX

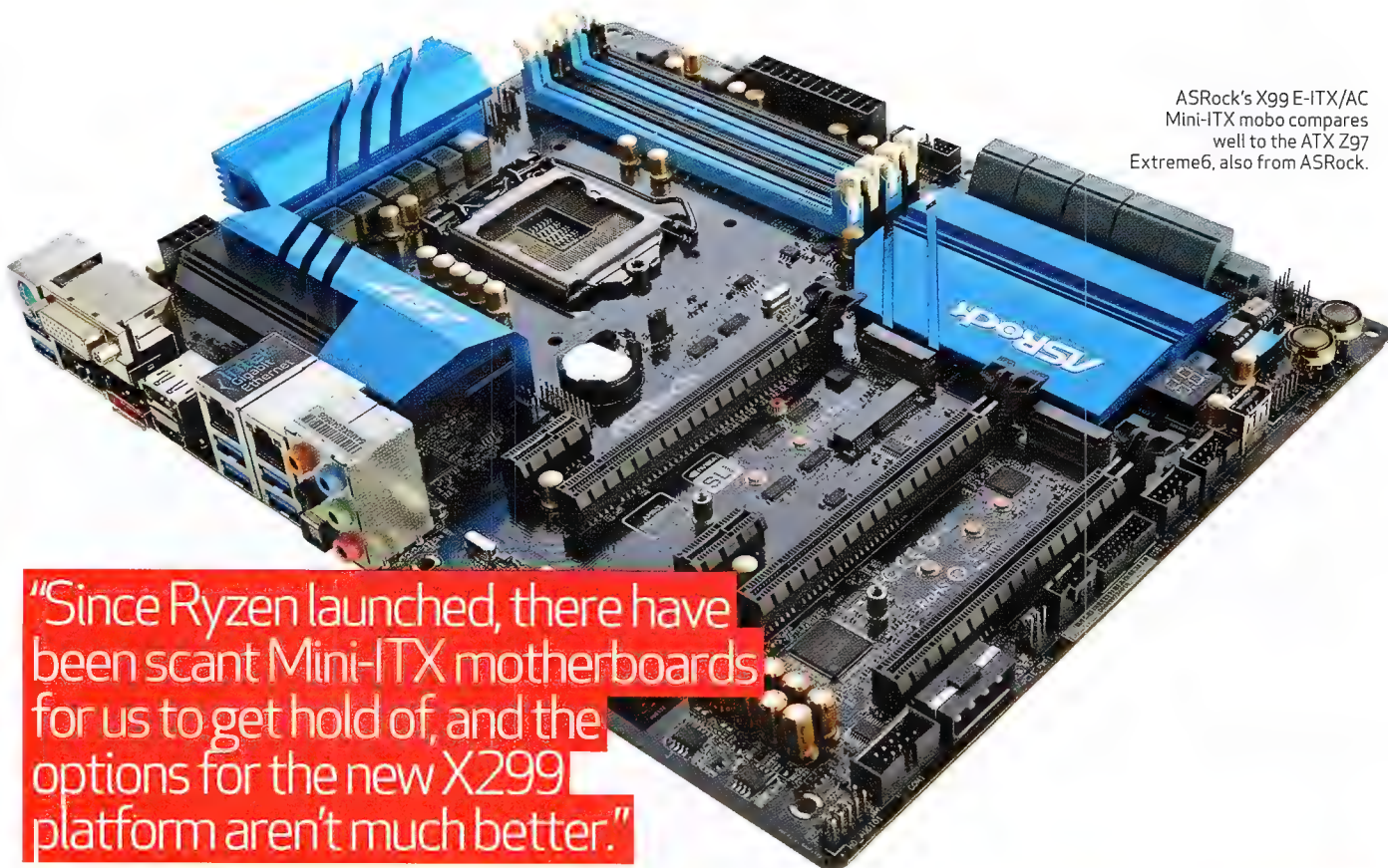
WINNER:

ATX

WINNER:

Mini-ITX

ASRock's X99 E-ITX/AC Mini-ITX mobo compares well to the ATX Z97 Extreme6, also from ASRock.



"Since Ryzen launched, there have been scant Mini-ITX motherboards for us to get hold of, and the options for the new X299 platform aren't much better."

Round 4

EASE OF BUILD

While we're big fans of compact Mini-ITX builds, there's no getting away from the fact that they don't always play nice. Confined spaces can lead to scrapes and cuts, but it's actually the frustration that comes from working in such a tight space that really grinds our gears. You can do it, and the resultant machines can make the effort pay off, but be prepared to spend much, much longer getting everything just right than with an ATX system. A tip on this front would be to connect and build as much as possible outside of the case before sliding your motherboard into place.

Conversely, building inside a large chassis is a pretty straightforward endeavour, with plenty of room for routing cables, space to easily reach components, and sufficient airflow without having to make sure every cable is tied down. You'll find you have more options when it comes to placing your components as well, whereas in a smaller chassis, you tend to find that there's only one place that your hard drive can go, or your all-in-one radiator can be placed. Adding more components to a bigger chassis is also much easier.

So it's a relatively easy win for the bigger form factor in this round.

WINNER:
ATX

Round 5

AVAILABILITY

Not only do you have the most options when looking at ATX motherboards, but new platforms are developed with ATX in mind. It's where most of the market is, so it makes sense to ensure that's working first. Other options, such as microATX and Mini-ITX, come later. That's been fine for years, as motherboard manufacturers have had plenty of lead time to get these niche platforms sorted, meaning there hasn't been much delay in getting your hands on a tiny motherboard. However, since Ryzen launched, there have been scant Mini-ITX motherboards for us to get hold of, and the options for the new X299 platform aren't much better — we're aware of a single X299 Mini-ITX board, the X299E-ITX/AC, which has to work some pretty impressive technical wonders in order to squeeze such a massive socket on to such a small board (like using SO-DIMMs).

The same is true for cases — smaller form factor chassis occupy a niche in the market. Which all adds up to a reduced selection for anything smaller than an ATX motherboard in a tower case. It's generally worth shopping around to get the platform and form factor you want, but your options will be more limited.

WINNER:
ATX

And the winner is...

We build plenty of machines here at APC: at least one an issue, and usually several more. The majority of these machines are ATX rigs (as we quite often like the bigger side of things), although over the past year, we've dabbled with Mini-ITX a few times. In other words, we have plenty of experience of building across various platforms and form factors.

Do we have a preference? We do have a fondness for smaller systems, as they look awesome when built properly, although we make no bones about the fact that they're not always the easiest systems to put together. Throw in some water cooling, and you end up with a machine that looks amazing on your desk, as opposed to something you want to hide under it.

These thoughts are reflected in this head to head — ATX is easier to build with, more readily available and offers more options for expansions and upgrades. Whereas Mini-ITX and microATX produce more compact systems, that perform just as well as their bigger cousins, and generally don't limit what you can do. At the end of the day, it's good to have options. ■



GRAPHICS CARDS

VEGA 56, \$600; VEGA 64, \$800 | WWW.AMD.COM

AMD Radeon RX Vega 56 & 64

It's been a long time coming, so is AMD's new Vega graphics tech ahead of its time, or just late to the party? Jarred Walton finds out.

Let's be frank: the Vega 56 and 64 are what we wanted to see last year, right around the time AMD was busy launching Polaris for the mainstream market. But Vega wasn't even close to being ready. So why did it take so long for AMD to get a high-end replacement for Fiji and the R9 Fury X out the door? AMD has talked about numerous architectural updates that have been made with Vega, and in the professional world, some of these could be massively useful, but as we're APC, we're at least equally interested in how these new cards stack up as a gaming device. So does it?

RX VEGA 64

Let's quickly talk specs. Vega includes 8GB of HBM2 memory in two stacks, which deliver the same 512GB/s bandwidth as the

four stacks of HBM1 in last-gen's Fiji, but with just two stacks, the silicon interposer doesn't need to be as large, and HBM2 densities have allowed AMD to double the amount of memory. But AMD isn't just calling this HBM or VRAM; it's now a High-Bandwidth Cache (HBC) and there's also a new High-Bandwidth Cache Controller (HBCC). The difference is important, because the HBCC plays a much more prominent role in memory accesses. AMD calls this a "completely new memory hierarchy". That's probably a bit of hyperbole, but the idea is to better enable the GPU to work with large data sets, which is becoming an increasingly difficult problem.

Vega also has a new geometry pipeline, with over twice the throughput per clock as AMD's previous architecture. The compute

unit has also been improved, with native support for packed FP16 operations, which should prove very useful for machine learning applications. AMD has improved the pixel engine, too, with a new Draw Stream Binning Rasterizer that helps cull pixels that aren't visible in the final scene.

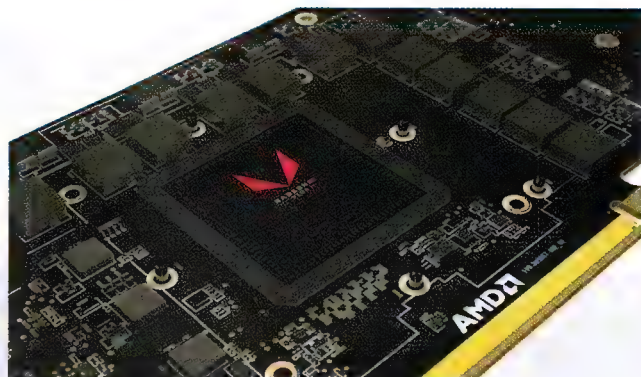
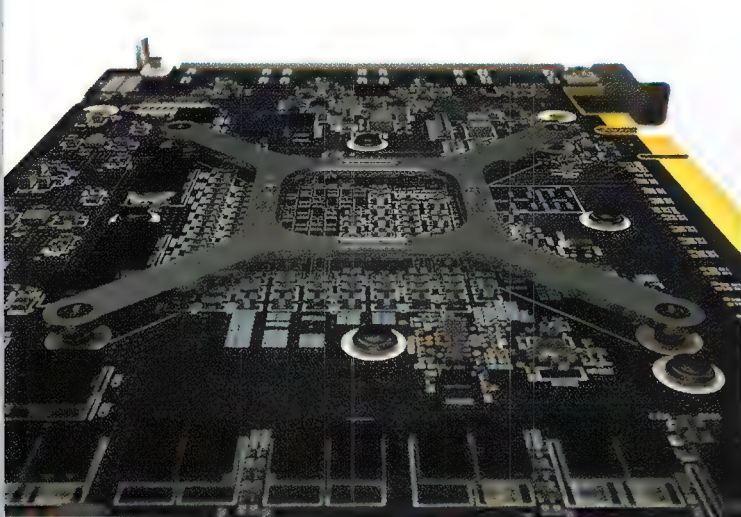
We didn't get the liquid-cooled Vega 64 for testing, but it should be up to 8% faster than the air-cooled version, based on boost clocks. If you look at the raw numbers, Vega holds promise — with higher theoretical computational performance and more memory bandwidth than the GeForce GTX 1080 Ti — but AMD's GCN architecture has traditionally trailed behind Nvidia GPUs with similar TFLOPS. DirectX 12 games, meanwhile, tend to track a bit closer to the theoretical performance, and certain

tasks (like cryptocurrency mining) can do very well on AMD architectures. But the power requirements of AMD GPUs have traditionally been higher than the Nvidia equivalents, and that remains true with Vega.

TAKING ON NVIDIA'S BEST?

Many in the gaming world were hoping Vega would be able to take down the heavyweight champion, the GTX 1080 Ti. In testing, however, that didn't happen, as the 1080 Ti remains out of reach, though to be fair, it also remains in a higher priced bracket. Based on cost alone, the direct competition for the Vega 64 is Nvidia's GTX 1080, while the Vega 56 is looking to take on the GTX 1070.

Vega 64 runs games fine — more than fine, as it's now the third-fastest consumer graphics card, and we'd



"Vega includes 8GB of HBM2 memory in two stacks. These deliver the same 512GB/s bandwidth as the four stacks of HBM1 in last-gen's Fiji, but with two stacks, the silicon interposer doesn't need to be as large, and HBM2 densities have allowed AMD to double the amount of memory."

expect nothing less for \$800. At best, Vega 64 is just a hair faster than the GTX 1080, but at worst, it can be about 30% slower — on average, the GTX 1080 leads by just under 10%.

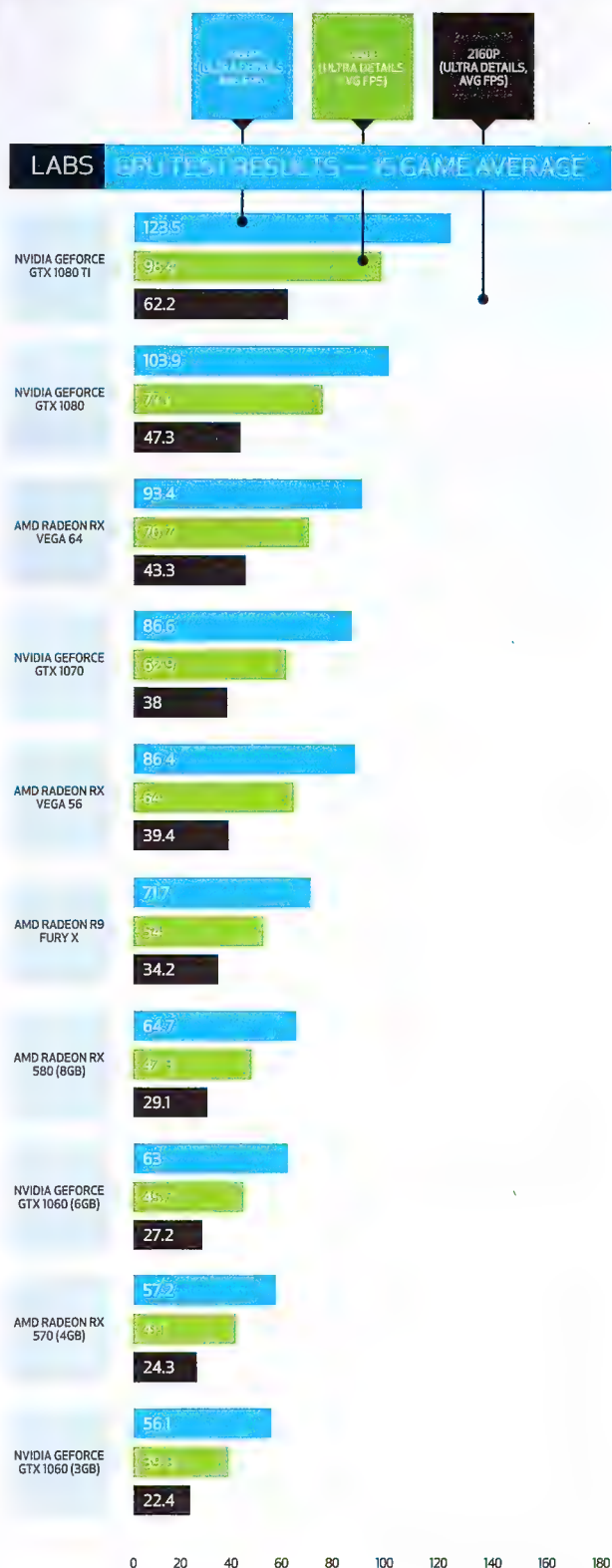
The Vega 64 really feels like a one-generation upgrade, despite the fact that AMD skipped updates to the high-end market last year. We often recommend skipping a generation or two of hardware between upgrades, which means upgrading every 2-3 years on graphics cards. Each generation will typically improve performance by 30% or so, and that's not usually enough to warrant an upgrade for most gamers. If you skip a generation, you potentially end up with a 60-70% performance jump. If you're already running a higher-end AMD card from last generation (like an RX 570 or RX 580),

then our recommendation to wait another round still stands.

What about power use? While it's a wash at idle, while gaming, the Vega 64 continues AMD's trend, using 478W at the outlet on the test system compared to 370W for the GTX 1080.

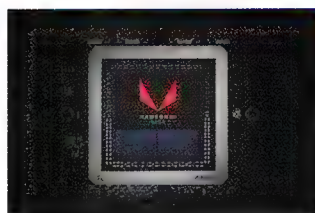
RX VEGA 56

Vega 64 was clearly designed to go after Nvidia's top parts. It came up short of the 1080 Ti, but is relatively close to the 1080. The Vega 56 doesn't aim quite as high or cost as much, so is it a better bet? While the power draw is still a bit high on this slightly lower-end card (as we measured 400W while playing games, compared to 314W for the GTX 1070), looking at just the Vega chips, the Vega 64 is only about 9% faster than the 56 overall, but it uses around 80W (20%) more





"The Vega 56 ends up being a good alternative to the GTX 1070, and an even better one if it's actually readily available at \$550-\$600."

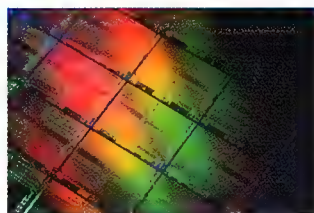


power. In terms of system performance per watt, the Vega 56 is, therefore, 10% better than the Vega 64, and if we look just at the graphics card, it's around 25% better.

AMD has included a BIOS switch along with a power-saving profile – but that comes at the cost of performance, of course. And if you want to overclock it, you still can, though that will affect the overall efficiency in the reverse direction.

OVERCLOCKING PERFORMANCE

We performed some preliminary overclocking, and things are far more interesting on the Vega 56 card than the 64, as you'd expect. Simply raising the HBM2 clockspeed to a 930MHz base (close to the same as the Vega 64's 945MHz) and cranking the power limit to 50% improved performance to where Vega 56 is effectively tied with the 64. Going further, we toyed with the



percentage overclock slider and managed to push it up 20% higher. In both cases, system power draw while gaming basically matched the Vega 64 – 480W at the outlet. But in limited testing, all that added clockspeed actually did very little for performance.

The Vega 56 isn't just more efficient than the Vega 64, though – when stock levels stabilise (at the time of writing, it was completely sold out worldwide), it should end up being a little cheaper than the GTX 1070, while delivering nearly the same performance overall.

The 56 ends up being a good alternative to the GTX 1070, and an even better one if it's actually readily available at \$550-\$600, considering the 1070 currently goes for \$600-\$650 or more due to mining demand.

STOCK PROBLEMS

Given the shortages on AMD's RX 570/580 cards, which are typically selling at prices 50% or more above



the MSRP, many have feared – and miners have hoped – that the RX Vega would be another excellent mining option. In Ethereum mining, so far, it's been pretty lacklustre, however, considering the price and power use. The Vega 56 manages around 31MH/s and the 64 does 33MH/s. Overclocking the VRAM helps boost both cards closer to 40MH/s, so at launch, that's not super promising.

Part of the problem is that most of the mining software (whether for Ethereum, Zcash or some other coin) has been finely tuned to run on AMD's existing Polaris architecture. Given time, we could see substantially higher hashrates out of Vega, and there are rumours that the right combination of VBIOS, drivers and mining software can hit mining speeds more than double what we measured. All we can do is hold our breath and hope that mining doesn't drive prices of Vega into the stratosphere in the future.

Considering the significantly higher clockspeeds, we had hoped Vega would perform far better than what we're seeing today. It's not a bad GPU by any means, but it's not going to dethrone Nvidia, at least not right now. What Vega does have going for it are reasonable prices, and AMD users will certainly appreciate having something that's clearly faster than both the RX 580 and the R9 Fury X. The real target would be gamers who are still running R9 290/290X (or older) hardware. ■

AMD RADEON RX VEGA 64

Verdict

AMD's new top-end option doesn't quite have what it takes to topple Nvidia's best, but its price/performance ratio still holds some attraction.



AMD RADEON RX VEGA 56

Verdict

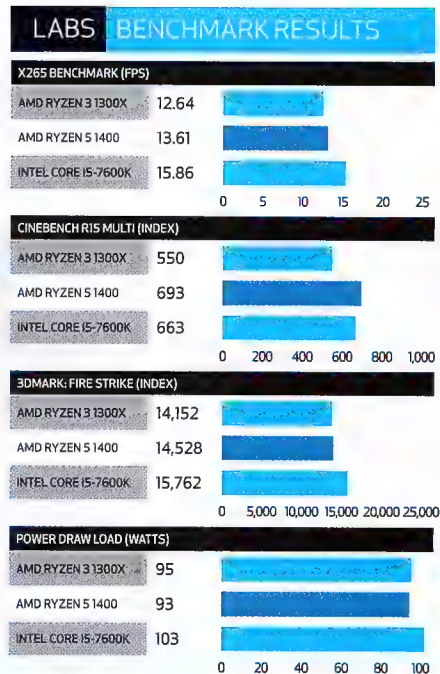
The cheaper of AMD's two new cards makes a bit more sense (than the 64), but miners should still steer clear for now.



apc
RECOMMENDED



AMD CPU | \$175 | WWW.AMD.COM



AMD Ryzen 3 1300X

Another month, another Ryzen to screw with Intel.

Ryzen 3 is the latest and most affordable subset of the AMD Ryzen family. Coming in two different guises, the Ryzen 3 1300X is the faster offering, packing support for XFR and a slightly faster clock speed over the Ryzen 3 1200, and it's completely unlocked. It is also more expensive than the 1200, although rolling in at \$175, it's still very much a budget offering.

The big news – when compared to Ryzen 5 and 7 – is that Ryzen 3 doesn't offer SMT support. Which means you get four cores to play with, but that's it. No extra cleverness to make the chip handle eight threads at once. Much like an Intel Core i5, then, albeit one that is closer in pricing to a Core i3. For this reason, we've compared it to the Core i5-7600K in our benchmarks, although such a chip will set you back about \$319.

So what does that \$175 net you? A quad-core chip with a base clock of 3.5GHz, turboing up to 3.7GHz. AMD's XFR (eXtend Frequency Range) will see this boost up to 3.9GHz, provided there is sufficient cooling. The Ryzen 3 1300X has a TDP of 65W, and ships with AMD's Wraith cooler, which keeps the chip in check quite comfortably and quietly. For our main testing, we swapped to the NZXT X62 Kraken, which we use for all of our CPU benchmarks.

There are no real surprises with the rest of the specifications, with the same 384KB of L1 cache and 2MB of L2 cache that you'll find on the other chips in the Ryzen family. Where it does deviate is in the amount of L3 cache – matching the 8MB of the Ryzen 5 1400, as opposed to the 16MB you'll find in the other chips. Again, this may lead you to think that the core configuration is a single Ryzen core complex, but as with the 1400, this isn't the

case; it's a similar 2 + 2 configuration that we're used to, just with some of the cache turned off, and SMT disabled.

As for performance, there's a lot to like from such an affordable little package, especially when you consider that you'll be able to slot this into a bargainous B350 motherboard and have a decent base for around \$300. We'll admit that it's odd seeing only four little boxes complete the Cinebench test, especially as we've quickly got used to seeing eight, 16 or even 32 of them, but the score is still solid enough. Single-threaded performance is still off the pace of Intel's, but compared to a Core i3, this is a strong win for AMD.

Games continue to favour Intel's chips, although the difference isn't as profound as it was when Ryzen first hit our test benches. Intel's slightly higher base clock helps here as well. Even so, there are only a few frames per second in it, with *Total*

War: Attila managing 36fps to the Core i5's 40fps, and *Far Cry Primal* recording 73fps to Intel's 77fps.

Overall, it's hard to argue against the Ryzen 3 1300X. It's a decent performer at a competitive price. Not a halo chip, like Threadripper, but it should still find its way into plenty of systems, and rightly so.

If you're in the market for a budget machine, this is a strong starting point. The only thing it doesn't offer the budget buyer is integrated graphics, so until AMD releases its Ryzen APUs, there's life in Intel's Core i3s and i5s yet.

Alan Dexter

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Great value for money, with a decent cooler, four real cores and completely unlocked.





2-IN-1 TABLET

\$1,475 | WWW.LENVO.COM/AU

Lenovo Miix 510

Can Lenovo's latest 2-in-1 take the fight to Microsoft's Surface Pro 4?

The market is flooded with devices with detachable keyboards that offer up Windows 10's capabilities as a tablet and desktop OS, including Microsoft's own Surface range. The Miix 510 is equipped with a latest-gen Kaby Lake version of the Intel Core i5 and a strong central pairing of 8GB of RAM and a 256GB SSD.

The Miix design language centres around two watchband-style hinges that give you more control and flexibility than the Microsoft Surface when it comes to the angle of the kickstand. It's an effective bit of industrial design from Lenovo. The ability to poise the device at almost any angle is a boon. Another plus is that the keyboard cover is included with the device. Like previous models, the Miix 510 comes with an active pen. Lenovo's stylus doesn't attach to the device via a magnet, although there is a loop on the included case.

There's an Intel Core i3 variant of the Miix 510, too, which has half the amount of memory and storage. This version will be fine for most basic tasks, but if you're looking at any kind of photo or video editing, we'd recommend the Core i5.

The Miix 510 is well designed. That's not to say it's a stunner, but it does look distinctive and those hinges give it a certain... something. The detachable keyboard with optional backlight also doubles up as a protective faux leather folio case, which works well. The side controls are a little plasticky, but it's a minor complaint. The keyboard cover sports Lenovo's AccuType-style keys, which are slightly curved along the bottom edge. They're sufficient in size but don't possess as much travel as the Surface Pro 4 cover, and this doesn't make for a great experience when you have a lot of words to type. The biggest problem is that the keyboard flexes a bit. If you're a hard typist, the

keyboard bounces rather angrily.

Elsewhere, the bezels around the display seem wide, but they don't make the device look chunky. Quite the opposite, the tablet looks sleek and professional. There's a lot to like about the display – viewing angles are excellent. What is a bit of a problem is the resolution, which sticks with Full HD, but it's not a problem in use, unless you're determined to have best-in-class specs.

There's plenty of 'everyday power on offer. Naturally, we're not talking about gaming, but between the fast PCIe SSD and the processor, there was no issue with any everyday tasks we tried. Plus, there's plenty to like in terms of entertainment performance and the Miix 510 is great for watching movies.

In our benchmark tests, the Miix 510 was... mixed. It scored a credible 6,570 in our GeekBench multi-core test, but battery life was substandard compared to

rivals, lasting 4 hours and 40 minutes during our looped video test, 35 minutes shorter than the Surface Pro 4.

It's great to see USB-C included, but we'd have preferred a USB-C charger rather than the round-ended charger we get here. Lenovo hasn't included a microSD port, which is surprising but not a deal-breaker.

So despite a compelling spec sheet and generally likeable appearance, the Miix 510 remains hard to recommend. But if price is your main motivator, you'll find the Miix 510 a passable alternative to the more expensive Surface 2-in-1s.

Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

A great-value tablet, as long as you don't mind its Full HD screen and rather limited battery life.





GAMING LAPTOP

\$2,998 | WWW.HP.COM/AU

HP Omen 17-an053tx

HP's latest 17-inch gaming rig is a monster, but is that bulkiness a good sign or not?

Weighing in at a hefty 3.8kg and with a body that's up to 3.3cm thick, the physical dimensions of HP's latest 17-inch Omen gaming laptop are as chunky and unwieldy as the gaming laptops of years gone by.

While the outer chassis is wrapped in patches of carbon fibre that give it a futuristic aesthetic, we were a little surprised to find that, under the hood, our test model 17-an053tx only had an Nvidia GeForce GTX 1060 GPU. However, the Omen manages to turn a confusing spec sheet into an assembled system that's surprisingly competent. Somehow, this thick lump manages to string together a set of components that appeared to be incongruous into one nicely-balanced monster gaming unit.

That said, it's hard to ignore the elephant-sized form factor. It's close to a third heavier than most other laptops we've tested

recently, and outweighs the heaviest GTX 1070-wielding laptop we have on record – Gigabyte's P57X v6, APC 434, page 18 – by more than half a kilo. While we were disappointed by this at first, a little digging uncovered that the bigger chassis allows it to use more modular components, so it can be customised and upgraded. The single removable back panel gives easy access to the SSD, HDD and RAM slots – and while this particular unit's 128GB PCIe Samsung SSD, 2TB Seagate HDD and 16GB of DDR4 RAM aren't going to need upgrading anytime soon, that's a handy feature for future-proofing.

If you've read our review of MSI's GE73VR 7RF (see page 26), we expressed some doubts about whether that unit's Nvidia GTX 1070 was a powerful enough GPU to make the most of its 120Hz screen. So when we learned that the Omen was sporting a similarly responsive gaming display, but using

only a GTX 1060 GPU, you can imagine our pessimism. Today's graphics chips are flexible packages, designed to boost up to higher speeds when it's thermally safe to do so – so variances in cooling systems used in gaming laptops means that some can perform better than they should on paper. The Omen is a clear example of this, netting real-world gaming benchmarks averages of 88, 68 and 57fps in the demanding *Batman: Arkham Knight*, *The Division* and *Far Cry Primal* tests. That last score managed to outdo three recent MSI laptops sporting 1070 GPUs, and those impressive scores were repeated across all our other benchmark titles. Perhaps the Omen's roomy chassis facilitates a more effective cooling array that allows for constant boosting, and significantly enhances the graphical performance.

The Omen's PCMark 8 Home and Work scores – largely powered by a quad-

core Intel Core i7-7700HQ CPU – did a decent job, too, although it only lasted 2 hours and 16 minutes in the battery benchmark. And while the Samsung 128GB NVMe SSD is on the small side, it's excessively fast, with read speeds of up to 2,980MB/s.

What's perhaps the most enticing is just how rich and vibrant the colours are on that 120Hz IPS display.

The Omen has turned conventional wisdom on its head, spinning a backwards David-and-Goliath story where the oversized underdog wins for a change.

■ Joel Burgess

Verdict

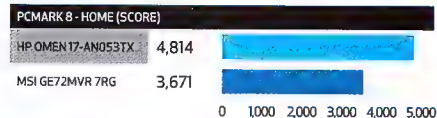
Features ★★★★★
Performance ★★★★★
Value ★★★★★

An oversized 17-inch gaming unit that pulls its weight in graphical performance and supports plenty of premium features.

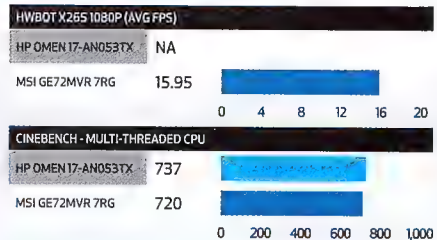


LABS BENCHMARK RESULTS

General performance



Media encoding performance



Graphics performance



Battery Life





GAMING LAPTOP

\$3,599 | AU.MSI.COM

MSI GE73VR 7RF Raider

MSI's super-slim and speedy-screened gaming laptop has a lot to like, but does it hertz the pocket a little too much?

At Computex 2017, one of the things MSI was most keen on highlighting was the 120Hz screens it's using in its latest gaming laptops, and while we agree there's definitely appeal in playing fast-moving games on a 120Hz monitor with a 3ms response time, the benefits over a traditional 60Hz display do depend heavily on the GPU's ability to run games at higher frame rates.

In addition to basically committing you to high-end (and more expensive) gaming hardware, a 120Hz screen will also generally have a narrower colour gamut than your average 60Hz IPS display. For anyone playing lightning-fast multiplayer first person shooters, those limitations may be well worth the benefits, but if competitive gaming isn't the primary purpose of your laptop, then the added expense of a 120Hz display becomes a slightly harder sell.

The speedy 17-inch 1080p screen on MSI's GE73VR 7RF Raider is supported by a 2.8-3.8GHz Intel Core i7-7700HQ CPU, 16GB of RAM and an Nvidia GeForce GTX 1070 (8GB) GPU, so there's plenty of power under the hood to run the latest games. The problem with this configuration is that, while it'll allow you to benchmark games like *Batman: Arkham Knight* and *The Division* at averages of over 60fps with 1080p and Ultra detail settings, you also get dips as low as 37fps – at which point, the 120Hz screen you just forked out for is really no better than its 60Hz counterpart.

From real-world testing with *PlayerUnknown's Battlegrounds*, we found we had to drop the graphics details down to Medium or Low before we hit frame rates consistently around the 60fps mark, but we were still getting dips as low as 36fps in intensive areas. The results were significantly better on more mature (but

less demanding) shooters like *Overwatch*, where our frame rates consistently sat at 70-90fps on Ultra settings – but on the whole, despite that GTX 1070, you'll likely find that only older games will be able to really utilise the fast screen.

The Raider continues MSI's tradition of a brushed-aluminium veneer casing on the keyboard deck and top of the lid, which uses novel angular accents and shaded red decals. The new per-key RGB backlit keyboard offers pleasant resistance and travel distance (as far as laptop membrane keyboards go) and the trackpad has a nice powdery feel. However, the thin mouse buttons and the dedicated function buttons (power, fan and keyboard lights) are made of a thin painted plastic, which feels a bit less premium than we'd expect at this price.

The Raider has a 256GB SATA 6Gbps Toshiba SSD and an adequate, but not overly large, 1TB Hitachi HDD. The well-specced CPU

performed as expected in PCMark 8's Home and Work related benchmarks and the 53Wh Li-Ion battery endured a reasonable 2 hours and 4 minutes.

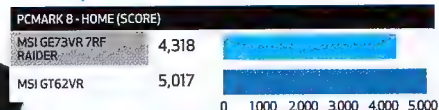
At 2.8kg and 2.9cm thick at its widest point, the Raider is refreshingly light and skinny for a 17-incher.

While the high-refresh screen and per-key RGB keyboard backlighting will only really be draw cards for those playing multiplayer first-person shooters and who like to colour code their keys, if that description matches your needs, then this one should please.

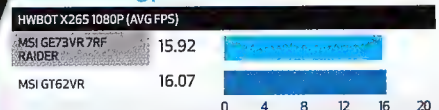
■ Joel Burgess

LABS BENCHMARK RESULTS

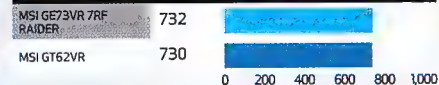
General performance



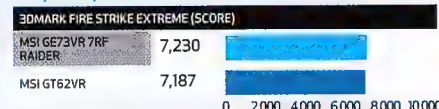
Media encoding performance



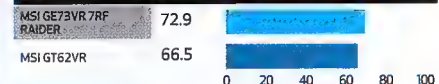
CINEBENCH - MULTI-THREADED CPU



Graphics performance



THE DIVISION - ULTRA 1080P (FPS AV.)



Battery life

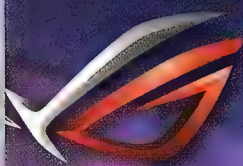


Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

A lightweight 17-incher with a 120Hz screen and a fast-enough GPU. Good for those looking for an edge in FPS titles.





NO. 1 GAMING BRAND WORLDWIDE

REPUBLIC OF GAMERS



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AMD
SocketTR4

X399

RYZEN
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Locked, Loaded & Ready to Rip

Best Cooling Performance

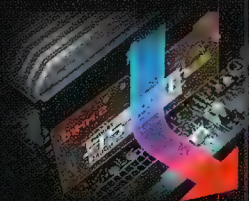
Comprehensive fan controls, perfected M.2 cooling, ROG Water Cooling Zone and the bundled DIMM.2 module and Fan Extension Card ensure that Zenith Extreme performs under pressure.

Best Gaming Networking

Level up to the latest 802.11ad (WiGig) Wi-Fi for multi-gig wireless transfers, and fit the included ROG Areion network card to experience extreme speed 10Gbps connectivity.

Best Gaming Personalization

Bring your ultimate gaming rig to life with Aura Sync, support for addressable RGB strips, and onboard LiveDash OLED with customizable animated GIF.



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FASTER 10G Port
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ASUS



www.asus.com/au/Motherboards/ROG-ZENITH-EXTREME



ASUS Australia & New Zealand



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FROM \$4,277 | WWW.ORIGINPC.COM.AU

Origin EON17-SLX

Desktop power, minus the desktop.

The EON17-SLX from Origin PC has all the components and performance of a top-end desktop PC crammed into a portable machine. Sure, it's heavy and bulky for a laptop, weighing 5.4kg (minus the two 330W power bricks) and measuring just shy of 5cm thick, but that's to be expected, considering the components inside.

The model we tested opts for a desktop-class Intel Core i7-7700K clocked at 4.2GHz. Combined with 32GB of DDR4-2400 RAM, the EON17 scored some of the highest benchmarks we've ever seen for a laptop. In Cinebench R15, it scored 893, which blows out our (admittedly out-of-date) APC Labs test laptop, and nearly matches the bar for desktops.

Storage is also an area where the EON17-SLX excels, because its primary storage is handled by a super-fast 512GB Samsung 960 Pro NVMe SSD – more than enough for the OS and

several large triple-A games. If that's not enough, the 960 Pro is backed up by a 2TB Seagate FireCuda flash-accelerated HDD. That's a ton of snappy storage space that makes the EON17 an excellent mobile workstation.

Now let's talk games. For pixel-pushing, the EON17-SLX packs two Nvidia GeForce GTX 1080s – the kind of hardware that makes gaming at 1080p seem rather pointless. Nonetheless, we conduct our gaming benchmarks at 1080p, so bear with us as we go through some numbers we would classify as 'overkill'.

Far Cry Primal was the EON17's weakest showing, with a frames-per-second score of only 91 in the game's built-in benchmark. That's still a good 20–30fps higher than most laptops we've tested, but not especially impressive compared to desktop hardware. *The Division* was a different story, with the EON17's 137fps nearly

doubling our APC desktop test computer. We saw the same thing in *Rise of the Tomb Raider*, where the EON17 scored an average of 115fps across the game's three-part benchmark (163fps in the 'Mountain Pass', 101fps in 'Syria' and 80fps in the 'Geothermal Valley') – much higher than both our laptop and desktop test rigs. 3DMark Fire Strike returned a score of 24,498 – similarly impressive, even by desktop standards.

Like we said, it's overkill for 1080p. But what about 4K? Origin's EON17-SLX is available in 1080p, 1440p with 120Hz refresh rate, or 4K at 60Hz refresh variants, all with G-Sync. The unit we tested was the 4K variant, which seems the most apt for a GTX 1080 SLI loadout – especially considering that SLI doesn't always play nice at 1080p.

The pair of cards performed handily at 2160p, maintaining average frame rates above 60fps in every gaming benchmark we performed. *Rise of the Tomb*

Raider returned scores of 94fps in the 'Mountain Pass', 71fps in 'Syria' and 70fps in the 'Geothermal Valley', for an average of 79fps. Similarly impressive, *Far Cry Primal* and *The Division* scored 75fps and 64fps, respectively.

Of course, laptop or not, most top-end gaming rigs that offer that sort of performance come with a price tag to match. The EON17-SLX is no different, coming in at an eye-watering starting figure of \$4,277. That's a big pile of cash – but, hey, you can't take it with you. The EON17, however, you can – just.

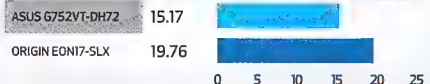
■ Bo Moore

LABS BENCHMARK RESULTS

CINEBENCH R15



TECHARP'S X264 (FPS)



CRYSTALDISKMARK 4K READ



CRYSTALDISKMARK 4K WRITE



FAR CRY PRIMAL (FPS)



THE DIVISION (FPS)



RISE OF THE TOMB RAIDER (FPS)



Verdict

Features ★★★★★
Performance ★★★★★
Value ★★★★★

Portable 4K performance and snappy storage sleek design, but quite bulky, heavy and expensive.





GAMING MONITOR

\$599 | WWW.VIEWSONIC.COM.AU

ViewSonic XG2530

If you have the need, this ViewSonic has the speed.

In the bad old days of the 2000s' CPU wars, megahertz became megahurts as the pursuit of clock speed for the sake of clock speed pushed Intel's engineers down an architectural dead end. Is something similar happening now with PC monitors and the quest for ever higher refresh rates?

The ViewSonic XG2530 blows straight through the likes of 120Hz and 144Hz, and motors right on up to 240Hz. That is one hell of a refresh rate. It's not the first monitor we've seen with such a capability, but it remains a startlingly high refresh rate. Moreover, it's hard to put a finger on where to draw the line with this particular technology, to grasp what the human eye can even perceive.

It's worth remembering that, when it comes to movies, 24fps is standard and 48 qualifies as a special HFR or 'high frame rate'. OK, movies and PC monitors are not directly comparable, but that does put 240Hz into

context. First, though, let's consider the XG2530 as a monitor in a general sense.

It's a 25-inch model, with a modest 1,920 x 1,080 or 1080p resolution, though given the refresh rate, and the bandwidth and pixel-processing implications of the 240Hz refresh, that's to be expected. Beyond that, it's not hugely remarkable on paper. The chassis and stand are quite high quality, with a full range of adjustability. There's support for AMD's FreeSync tech, and TN panel tech.

That's not a huge surprise, given the 240Hz refresh, as TN is the quickest panel type. What is a pleasant surprise is the quality of this particular display. We've seen nice TN monitors before, but until now, they've all been 4K models. To be clear, we're not talking here about resolution and sharpness. It's colours and contrast where the XG2530 shines.

By those metrics, this TN panel has closed much of the gap with a middling IPS

panel, and surpassed a cheap 6-bit IPS screen fairly comfortably. Saturation levels are very high and static contrast is strong, combining to deliver a very pleasant, punchy overall appearance. If you really want to be critical, there are faults. Most notably, the viewing angles are pretty much garbage – but, then, that's TN for you.

Beyond that, we're talking details, including some obvious banding in standard gradient images. More problematic is the panel's overall accuracy. There's some compression in darker tones that can lead to a loss of detail in games and movies – not catastrophic, but something you don't have to put up with when using a good IPS panel.

That 1,920 x 1,080 res makes for limited desktop space, of course, and paired with a reasonably expansive 25-inch diagonal, results in a fairly coarse pixel pitch.

But then there's the 240Hz shizzle. We admit that some may not sense the subjective

benefit versus what you might call a regular 120Hz panel. But we can feel the difference, even if it's not as significant as going from, say, 60Hz to 120Hz. A 240Hz screen makes for incredibly responsive gaming.

Up to this point, at least, it's not just about putting bigger numbers on the spec sheet. Combined with zappy pixel response and the punchy panel quality, it's a very compelling gaming proposition – a different proposition compared to a 4K 60Hz panel, of course, and the detail that one can offer, but compelling all the same.

■ Jeremy Laird

Verdict

Features
Performance
Value



A surprisingly good quality TN panel with super-quick response time.





PORTABLE SSD

250GB, \$199; 500GB, \$329; 1TB, \$649; 2TB, \$1,249 | WWW.SAMSUNG.COM/AU

Samsung T5 Portable SSD

Samsung feels the need for speed... again.

Samsung's back with another super-fast portable storage solution, returning to the well that it first dug in 2015 with the T1 drive – and this USB external drive promises even quicker transfers speeds.

With a similar brushed aluminium unibody design as last time (sans the two-tone styling), the T5 is almost exactly the same size as its previous-gen incarnation, shaving off just under a millimetre from the T3's width. A USB Type-C port lets you switch between the included Type-C to Type-A and Type-C to Type-C cables, the latter being especially convenient for use with newer MacBooks and other ultraportable laptops, or even Android phones. For those who want to keep their files secure and away from prying eyes, AES 256-bit hardware encryption is available, which creates a secure partition on the device that you need to unlock via a preloaded encryption app.

Once installed, the SSD requires the user to enter a password before they can view the contents within.

But the real selling point is the transfer speeds, and we're pleased to say that the T5 is no slouch in that regard. Our CrystalDisk Mark tests revealed sequential multi-thread read and write speeds of 437MB/s and 444.3MB/s, putting it in first place amongst rival portable SSDs (Samsung's T3 was the previous leader). In terms of large single-threaded transfers, the T5 fell short of the WD My Passport SSD's 431.1MB/s and 420.3MB/s record. But we preferred the T5's thinner profile and rounded edges, so we know which way we'd flop. ■ **Stephen Lambrechts**

Verdict

An elegant design backed by strong encryption, with incredibly fast transfer speeds.



3.5 INCH NAS HARD DRIVE

10TB, \$600 | WWW.SEAGATE.COM

Seagate IronWolf Pro

Does your NAS deserve the upgrade?

While the normal Seagate IronWolf NAS drives are aimed at home or small business use, the Pro drives are for creative professionals, and lighter enterprise use.

The IronWolf range uses a SATA 6Gbps interface, has up to 256MB cache, and a 7,200rpm spindle speed. Aimed at those who work their drives harder, the Pro IronWolf is rated for 300TB of data written a year, versus 180TB for the normal version. The warranty is also bumped up to five years, from three, and the mean time between failures (MTBF) to 1.2 million hours, rather than 1 million. The Pro drive also includes two years coverage with a data recovery service, for extra peace of mind.

Theoretical performance only sees a mild bump for the Pro (especially for the smaller capacities) and in real-world NAS testing, we saw no significant

difference as the speed is bottlenecked by the network. In PC-based sequential testing, the 10TB drive hit 173.5MB/s reads and 170.9MB/s writes, with random speeds at 0.78MB/s and 1.64MB/s, respectively.

The Pro drives are available in 2TB, 4TB, 6TB, 8TB and 10TB – all with rotational vibration sensors. The Pro drives also support up to 16-drive RAID sets, rather than eight for the standard model. Make sure to compare prices – the cost per TB improves the larger you go, and the price difference to the non-Pro model drops dramatically. For example, the 10TB IronWolf is 92% of the cost of the Pro, making for no brainer upgrade.

■ **Lindsay Handmer**

Verdict

High-end NAS-focused features with competitive pricing in the largest capacities.





USB-C DOCK

\$530 | WWW.BELKIN.COM/AU

Belkin Thunderbolt 3 Express Dock HD

An expensive little friend for your MacBook.

The aluminium finish and tapered design are undeniably sleek, and thanks to its moderate size, it neither dominates the desk nor gets carried away by the weight of the connected cabling.

The dock can support two external 4K displays via one of its Thunderbolt 3 ports and the DisplayPort, or alternatively, a single external 5K display. You'll find the standard affair of ports — two super-speed USB-A 3.0s at the rear and one at the front, Gigabit Ethernet connection and two 3.5mm jacks for headphones and mics.

The show-stealers come in the form of the two Thunderbolt 3 Type-C ports, one of which will attach to your MacBook and provide it with up to 85W of power along with data transfer, and the other of which can be used for displays, hard drives and other connections, even allowing you to daisy chain up to five devices.

If you intend on using an external hard drive, we'd recommend connecting it via the Thunderbolt 3 connection, as it will get you close to the same speeds as plugging directly into your computer (around 420MB/s using a Samsung external SSD), whereas the USB Type-A port suffered around 100MB/s drops in both write and read speeds in testing.

This is a very expensive dock, but the \$500 mark is pretty standard for a Thunderbolt 3 dock with this kind of featureset. As such, before buying the Express Dock HD, we'd make sure that you actually need everything it has to offer, as you can definitely get a more affordable alternative that ditches the higher-end features. ■ Harry Domanski

Verdict

While expensive, this MacBook USB-C friend supports a lot of device options.



USB MICROPHONE

\$300 | WWW.ASUS.COM/AU

ASUS ROG Strix Magnus

Novel deodorant stick or desktop mic? You decide...

So ASUS is trying to sell you Optimus Prime's beard trimmer. Like streamers didn't already have enough to answer for, the Magnus is the latest manifestation of their influence, a USB-powered, desktop mic, designed for in-game chat and casting.

But there's a definite gap in the market for a product like this. Streamers have migrated away from the scratchy world of headset microphones in favour of quasi-studio mics. The benefits are obvious: vastly improved sound and more control over it. But can this offer something over the cheaper competition?

It depends on how much value you place on RGB lighting. Admittedly, it's an easy setup job: pull the mic out of its carry-case, attach the meaty braided USB cable to the mic input and an available USB 3.0 port, and you're done. You can use a USB 2.0 port in a pinch, with limited functionality, but it's preferable to just

give it the juice it needs. You can use ASUS's Aura software to customise the lighting, but surprisingly, there are no options for the audio itself. That absence is keenly felt when it comes to the 'ENC' noise cancellation mode. In testing, we found it too aggressive, clipping consonant sounds and producing a really low overall sound quality. ENC is one of three mic pattern modes available here, with unidirectional (cardioid) and stereo (bidirectional).

The Magnus certainly isn't at the level of studio mics, such as Audio-Technica's AT4050. It's hard to recommend this one — unless you're a Transformer with a bit of unwanted stubble around the jawline, that is. ■ Phil Iwaniuk

Verdict

Do you need one? Probably not, but people don't strictly need fidget spinners either, yet here we are.





GAMING MOUSE

\$249 | WWW.LOGITECH.COM



WIRELESS CHARGING MOUSE MAT

\$149 | WWW.LOGITECH.COM

Logitech G903

The premium wireless gaming mouse just got recharged.

Logitech's G903 wireless gaming mouse looks rather more like the angry fire-spewing alien beetles from *Starship Troopers* than a PC mouse. This symmetrical, black scarab will suite both left- and right-handers, but its thinner shape does make it best for users who err towards a claw or fingertip style gripping technique.

Although there's enough rump to support your palm, its overall shape seems primarily aimed at putting users in a position to be twitch-responsive and competitive. With a one-millisecond response rate, Lightspeed wireless and Logitech's best PMW3366 full-range optical sensor, you have an exceptionally responsive wireless mouse that suffers from zero lag.

It's quite customisable, too, with a tri-click scroll wheel that can be toggled for notched or free-spinning scrolling. There's a dual-direction DPI adjustment button and a spare set of

side buttons and bumpers to give you total control of the physical layout, as well.

Logitech's Gaming Software allows you to customise further, with full button configuration, DPI profile tweaking and RGB lighting synchronisation. The mouse also includes an additional 10g weight-insert to give it more inertia – although, unfortunately, the Powerplay module that allows wireless charging uses the same slot on the mouse's underside.

At \$250, the G903 is pricey (even by wireless mouse standards), but if you want competition-level responsiveness, a sleek and customisable design, and cutting-edge wireless charging, then this is the mouse to beat. ■ Joel Burgess

Verdict

A full-featured wireless-charging remake of the most desirable gaming mouse on the market.



Logitech Powerplay

Finally, the charging solution wireless gaming mice have been waiting for.

Back in May, Corsair introduced the first mousemat (the Zeus) that'll recharge the mouse that sits atop it, doing away with the need to ever plug in the latter or swap out batteries. But while the Zeus is just at concept stage, Logitech has, out of nowhere, been able to launch a fully-functional wireless charging mat that's available right now.

It's natural to worry that the Powerplay charging system might have been rushed to market. Yet despite its rather sudden appearance, based on our testing, this is definitely a mature product – and one that more than lives up to its claims. The mat is made up of the mouse pad surface, the base charging mat and a wireless receiver. The mat needs to be plugged into your PC via USB.

With a footprint a little larger than an A4 sheet of paper, the Powerplay offers enough surface area for most, and comes with both hard plastic and soft fabric

mats. What's perhaps more critical, though, is the wireless connection. The Powerplay signal receiver includes Logitech's Lightspeed wireless tech, good for one-millisecond 'competition-level' responsiveness.

The attachable puck-shaped wireless charging module will keep both the compatible mice (G903 and G703) at 85–95% of max battery capacity – this range prevents cell damage.

The downside of this new tech is the price. At \$150 for the pad alone, you're looking at an outlay of at least \$300 to get started. If you're willing, however, the high-quality components of this convenient wireless gaming mouse setup won't let you down. ■ Joel Burgess

Verdict

An impressive wireless mouse peripheral offering precision and convenience, for a price.





GAMING MOUSE

\$149 | WWW.LOGITECH.COM

Logitech G703

A Powerplay-compatible wireless gaming mouse for \$100 less.

If the G903's \$250 price point is too dear, or you don't like its design, Logitech thankfully has another Powerplay compatible wireless mouse on offer: the ergonomically shaped G703 – an upgraded version of the G403.

The G703 has fewer features and customisation options than the higher-end G903, but the main difference is a flatter and wider design that's a bit more comfy for palm-grippers – although at 107g, it's still lightweight enough that more finger-oriented grip styles work fine, too.

The pain point for wireless mice is recharging them, but even if you're not willing to fork out another \$150 to get the Powerplay mat, the G703 manages charging fairly seamlessly. As with the G903, there's a 1.83m braided USB cable included in the box, which will securely plug into the front of the mouse to charge it – and this doesn't impede performance, meaning that, when tethered, the G703

works just like an other wired gaming mouse. With 2–3 hours per day of gaming with medium/high-sensitivity settings, we found ourselves recharging the mouse every 1.5 weeks or so – almost bang-on Logitech's claimed 32 hours.

There's little between the G703 and G903 – both use the same sensor (the Pixar PMW3366, 200–12,000dpi) and Logitech Gaming Software for sensitivity, button and lighting configuration. The G703 has only one DPI button, though, so you need to cycle through different sensitivity settings, rather than move back and forth), but it's well-equipped with six programmable buttons. So it still packs in all the critical elements. ■ Dan Gardiner

Verdict

A cheaper alternative to the G903 that's arguably actually better in some ways.



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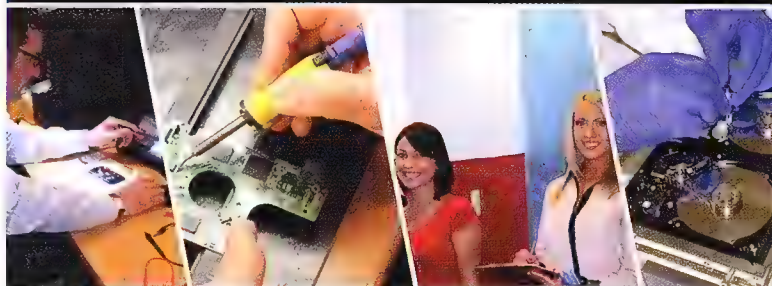


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GAMING KEYBOARD

\$150 | WWW.ASUS.COM/AU

ASUS Cerberus Mechanical RGB Gaming Keyboard

Mechanised and illuminated.

ASUS is looking to change the playing field with this entry-level mechanical RGB gaming keyboard promising great specs at a price that most of us can actually afford.

Lay your hands on this baby and you'll immediately notice the rubberised plastic that covers every surface – this is a pleasure to touch but a smudge magnet. While the four included spare keycaps don't get this rubber treatment, their orange-red colour ensures those W, S, A, D keys still stand out. The keyboard can lie flat or at a slight angle, but those who like a wrist rest should look elsewhere.

The overall aesthetic is minimalistic and tasteful, which is quite refreshing. The only strong assertion that this is a gaming 'board is the RGB backlighting, offering per-key colour configurations with seven effects that you can save to one of six profiles. You can also save any macros you record to those profiles,

and easily switch between them by hitting Function plus F1 through F6. The ease of configuration is one of the Cerberus keyboard's greatest strengths, with the ASUS Armory software making short work of setting up new profiles.

The switches are Kaihua branded and come in Red, Blue, Brown and Black – the Red switches we tested felt almost identical to their Cherry counterparts. While there are alternative gaming keyboards with heavier feature-sets, these always cost more (up to twice as much, in the case of the Razer Blackwidow 2 Chroma) and for some, the simplicity of the Cerberus will be a key selling point, rather than a drawback.

■ Harry Domanski

Verdict

For an entry-level gaming keyboard, it's a great balance between function, price and style.



GAMING HEADSET

\$TBA | WWW.ROCCAT.ORG

Roccat Khan Pro

The world's first hi-res audio gaming headset.

Roccat's Khan Pro headset is the first ever gaming headset to come with certified hi-res audio status, bringing that requisite 20Hz-40KHz response range in tow. But what does hi-res audio do for a gaming headset?

A great deal. Like other Roccat headsets we've tested, the construction materials and visual design here don't scream 'premium'. A largely plastic body and creaky earcups prove to be only minor marks, though – elsewhere, it's deceptively brilliant. Controls are kept to a minimum, with a simple volume scroll wheel at the back of the left earcup, and a mic mute function tied to the swingarm. We would have liked a chat/game mix scroll, too, at this price point (they should cost under \$200), we can let that one go. The braided cable connects via two 3.5mm audio jacks for mic and audio, rather than USB, and there's a single-input adapter for mobile devices included

in the box.

When you start pushing sounds through the headset, it's difficult not to be impressed. It managed to find more clarity, bass response and articulate mids than most other sets we've tested. Its response sounds similar to our ears to the venerable HyperX Cloud and Cloud II from Kingston. They sound dreamy when listening to lossless audio.

The real question is... How often do you listen to hi-res audio? While it's growing in popularity in PC games, it's by no means the standard.

If that exemplary sound quality came in a more luxurious overall package, this would be a genuine best-in-class contender.

■ Phil Iwaniuk

Verdict

Hi-res audio, flat response, beefy lows... in all, it's very good for the price.



software

» APPS FOR ALL THE PLATFORMS



Windows SOFTWARE

OBS Studio

Everything you need in order to live-stream and record video using multiple sources.

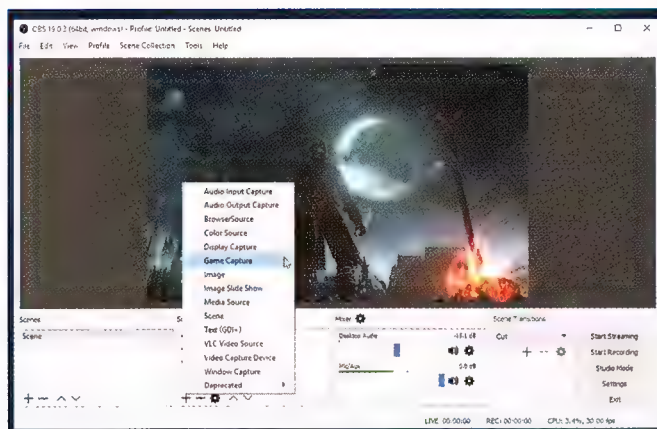
FREE | OBSPROJECT.COM



YouTube gives anyone the opportunity to become a broadcaster, but in order to get started, you're going to need some sort of software to mix video content together. It may be that you're just recording a straight piece to camera, but it's more likely that you'll want to create something a little bit more complicated that involves the use of multiple video sources.

Using OBS Studio, you can record directly from your webcam and microphone and then incorporate footage from games, add in existing videos and still images, capture a window or a portion of your screen, and much more. This open-source Windows app enables you to work with these multiple sources, mix between them and create one seamless broadcast. This can take the form of a recorded video — a good option if you'd like the opportunity to go back and edit out mistakes, or you just want to be able to give things a check through — or you can live-stream and mix at the same time.

With support for video services including YouTube, Twitch, hitbox.tv, DailyMotion, beam.tv, Livecoding.tv, Facebook Live and Restream.io, all of the major platforms are covered.



OBS Studio is particularly good for live-streaming to Facebook, Twitch or YouTube, and while mixing sources can be intimidating if you're doing it live, it's thankfully easy enough to get used to how things work by recording a few test videos beforehand.

The workflow could perhaps be a bit more intuitive, but nothing is so complex as to be unusable.

OBS is the most powerful free screen recorder and streaming tool available for gamers, with everything you need to achieve professional results. It might take a little while to familiarise yourself with its interface, but the effort will pay off.

Mark Wycislik-Wilson

BlueStacks App Player

Get (almost) all your favorite Android apps on your desktop.

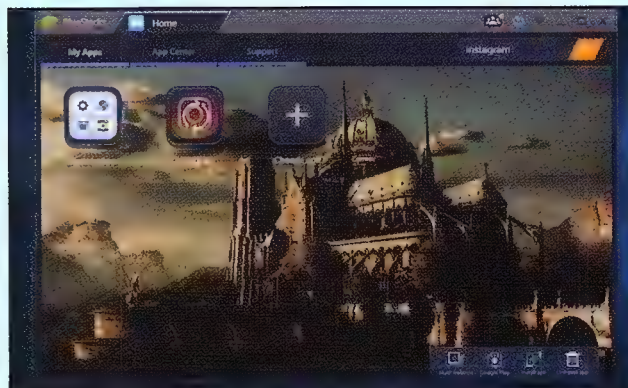
FREE | WWW.BLUESTACKS.COM



One of the downsides of the mobile revolution is that some apps never make it across to Windows. The developers make an iOS app and an Android one, but don't then bother porting the app to Windows. BlueStacks App Player solves that problem by enabling you to run an Android emulator on your PC or Mac, meaning you can run basically any Android app available — and it's a particularly handy tool for developers, too.

That's because it lets you test Android apps without shelling out for any additional hardware or installing it directly on your phone. And if you already have an Android device, you can actually use the BlueStacks app on your PC to control the apps installed on your phone.

That might sound complicated, but BlueStacks is very simple to use. Once you've logged in with a Google account, you can



access the Google Play Store as you would on a mobile device and install the apps you want to try. There are also quick links to some of the most popular apps on the homescreen to save you a few clicks, too.

Cat Ellis



Mac » APPS

HoudahSpot 4

Turning up the Spotlight power.

US\$29 | HOUDAH.COM

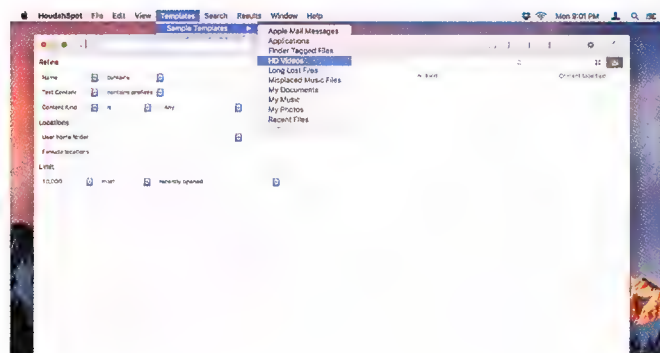


The Mac's Spotlight search engine has added lots of new features in recent years, but as a tool for searching your computer, it remains basic.

That's where HoudahSpot comes in. It uses the Spotlight index but allows you to build searches using a variety of criteria and save them as templates, somewhat like Smart Folders. And it's mighty fast. It comes with lots of prebuilt templates; new in version 4.2 is one that enables you to search for all video files of HD resolution on your Mac.

While HoudahSpot presents an interface that may seem daunting, selecting a template from the Templates menu quickly reveals the app's power and ease of use. So, for example, choose Mail and you'll see a list of search criteria in the left-hand sidebar. You simply fill in the ones you want to inspect and press 'play' — it's that easy.

Once you've pinpointed what you want, you can double-click to open it in the specified app; open it in another app;



or tag, rename, copy or move it. It's powerful stuff. HoudahSpot is ideal for anyone who craves more powerful searching than Spotlight in macOS. **Kenny Hemphill**

WinZip 6 for Mac

Surely that'd be 'MacZip', then?

\$43.95 | WWW.WINZIP.COM



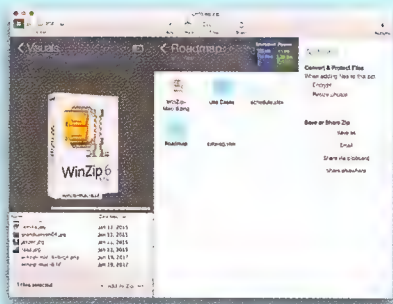
Mac compression utilities aren't sexy — if they reduce file sizes and use less bandwidth, it's a job well done. Corel brings some of the sizzle back in WinZip 6 for Mac, which now manages files,

as well as compacting them.

This is done from a new Files pane on the app's left-hand side, where you browse mounted volumes, cloud storage accounts, and the last five archives accessed. Rather than dragging and dropping from Finder or using the Action menu, everything happens inside WinZip's window, with the pane expanding into split-screen view alongside the current archive while browsing.

WinZip isn't quite a full-fledged file manager — you can't view two volumes side-by-side, for example — but the improvement will be welcome if you work with Zip, GZip, LZMA2, BZip and other archive formats. Contextual menus provide a convenient peek without opening files, and you can delete and rename files from within the app. There's also enhanced support for Zipx. It's more convenient than ever, but there's no upgrade pricing.

JR Bookwalter



Screens 4

Get at your home or work Mac while on the move.

US\$32.99 | EDOVIA.COM



Screens 4 enables you to connect to your Mac from anywhere there's an internet connection. Once connected, you can control the Mac remotely as if you were sitting in right front of it. Version 4 adds the ability to transfer files by dragging and dropping between your local Mac and the remote one, as well as a feature that obscures the display of the remote Mac while you work.

If you connect to a Mac with multiple displays attached, you can choose which of them you want to view, or see all of them at once. And if you connect to multiple Macs, you can save them and arrange them in groups to help you find them easily later.

Setting up Screens is straightforward. On a local network, Macs are automatically detected, though you'll need to switch on Screen Sharing in a remote Mac's System Preferences to control it. To connect over the internet, you need to set up a Screens account and run the Screens Connect utility on the Mac you want to connect to.

We found Screens worked well, and connected quickly over our local network. For the most part, it worked exactly as it should. However, we did run into occasional problems when trying to drag and drop files between our local Mac and the one we were connected to. Likewise, we sometimes ran into problems copying and pasting between remote and local Mac. Those problems could have been down to our network, however. Other than that, we found Screens to be a snap to set up and a pleasure to use.

If you need to connect to a remote Mac, for whatever reason, Screens 4 is a great way to do it. **Kenny Hemphill**

Steno

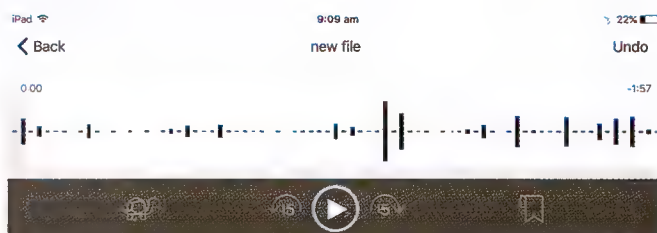
A live transcription app that sadly didn't like our Aussie accent.

FREE WITH IAP | WWW.BLUESHIFTDEVELOPMENT.COM/STENO



As anyone who must transcribe interviews for a living must surely know, transcribing is among the most tedious tasks one can complete while seated.

So apps like Steno are meant to help out: it's a voice recorder which also tries to offer a transcription as the conversation is happening. It's a dream come true, but alas, not a particularly vivid dream. The problem is that Steno doesn't transcribe especially well, though I'm willing to blame that on my rural NSW accent. To be honest, I could barely recognise the transcription offered after running a short test conversation with it, and I was speaking clearly (I thought), without interruptions. But, of course, your mileage may vary, and the app is free to try, offering 30 minutes of transcription and then an additional 50 minutes for \$0.99, 250 minutes for \$3.99 and 500 minutes for \$6.99. If you speak the Queen's English, maybe you'll have some luck. **Shaun Prescott**



Or I am Talking. In order to test this. Five transcription Pop. And by the looks of things. It does not work.

Perfectly Run orange juice. Trying to explain Screen shows Theis. Right heavy Jordan's listen to popular so that's not in the menu bar

So not personal purple. Alright. So not personal purple is one of four he said. Or is this a. Yes. Joe do you think spelunking is the best game ever made

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You %HESITATION three thousand words a little ha ha ha ha bonus seafood has. Open book bracket close out lofts scurries.

Year hesitation three thousand words a little ha ha from going to see food has. Quote.

Genius Scan

A scanner in your pocket

FREE; \$7.99 SCAN+ | WWW.THEGRIZZLYLABS.COM



One of the great things about having a smartphone is the potential that gives you to carry digital versions of documents with you whenever you go. So what if you already have things printed out and want to digitise them, but have no scanner? Genius Scan is one of many document scanning apps around that endeavours to capture your documents and reproduce them into a clear file. Simply lay your file down flat (tip: try to get out as many creases as possible, as these turn up as lines on the finished product) and then press the capture button. The app will take a few moments to detect the edges of the page (sometimes, it'll have problems doing this), then you'll see a crisp black-and-white file appear in your library. You can add tags, rename the image, rotate and perform some basic editing, and put it into a group with other files. It works with pages of all sizes, so you can easily store all your receipts in the app, ready for any time you need them. There's also a few different export options. Upgrading to Scan+ not only gets rid of the rather non-invasive ads, but gives you options to upload to the cloud service of your choice, as well as import docs from other apps, encrypt your files and much more. However, as good as Genius Scan is, the future of these sorts of applications has been put into question (at least, on iOS) with the arrival of Apple's Notes scanning feature, which does pretty much the same thing. There's also a range of other existing apps, such as Evernote, that provide this feature as well — which you may already have on your phone. **Carmel Sealey**

PDF Expert 6

Document editing par excellence.

\$14.99 | PDFEXPERT.COM



When it comes to editing PDF files, mobile apps have always been more limited than Mac or PC. Leave it to the folks at Readdle to deliver desktop-class features that go beyond basic annotation, form-filling and signatures.

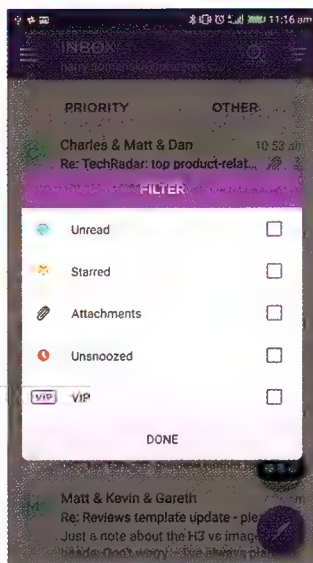
PDF Expert 6 adds the ability to also edit text, add or replace images and redact sensitive information inside documents. It's a brilliant update that turns the app into a true productivity powerhouse for all but the most advanced PDF capabilities.

In addition to the trio of new editing features, you can also add web links to text or pictures. The tools at your disposal are exceptionally intuitive; for example, after selecting an existing image inside a document, you have the ability to rotate, replace, save, crop, copy or delete, as well as resize or reposition it with ease.

Editing features require an additional in-app purchase, which costs \$14.99, and replace the iPad version's woefully inadequate Markup tool, a workaround that allowed rudimentary text editing for free. PDF Expert 6's editing features are well worth the one-time upgrade, though. The remaining new features are free for existing users, including an interface overhaul with enhanced search, outline editing, and the ability to password-protect documents. Cloud support is also more robust — edits are now saved directly to your favorite service. iOS's best PDF editor gets better. **JR Bookwalter**



Google Play » ANDROID



Meet Astrobot

Our bot helps you clean your inbox and reminds you about important emails.

Astro: AI Meets Email

You've got mail, now get smart.

FREE | HELLOASTRO.COM



Astro is a streamlined email client that utilises an integrated AI to smarten up the whole ordeal. The interface is gorgeously simple and, naturally, the app comes with the usual inbox management suspects like snoozing, open tracking and send-scheduling. The big point of difference with the Astro client is its specialised Astrobot AI, which is delivered in the form of a chatbot. Astrobot will intelligently notify you of what it thinks are important emails and significant items within them – such as dates, invoices and anything sent from your specified list of VIPs – and you'll be able to tell it to remind you about such items as well. It'll also provide you with suggested actions to certain emails, such as 'unsubscribe' or 'follow up', depending on what Astrobot has picked up from the email's contents and similar emails in the past. The chatbot also plays nice with Slack and Amazon's Alexa (which technically hasn't yet come to Australia), so you can achieve some neat cross-platform integration and send attachments to your colleagues or friends. Overall, this is an excellently sleek smartphone email client, even for those not interested in using the AI functionality. **Harry Domanski**

Firefox 54

A browsing success.

FREE | WWW.MOZILLA.ORG



The battle of the browsers is a bit like *Game of Thrones*. House Microsoft ruled for years, before Mozilla's bannermen came through and put paid to its autocracy. House Chrome then sweeps across the globe, winning the love of the people. Wheels turn, and now Firefox is in open rebellion after a bunch of smart updates, though it requires fealty of your phone's RAM. Don't get this confused with Firefox Focus, a stripped-back version that eschewed tabs for blocking ads and could trash your history at the hit of an always on-screen button. This Firefox is more 'full fat', replete with multiple tabs and a so-simple-why-isn't-everyone-doing-this bookmarking system that sorts by tags rather than rigid folders. It's lightning fast at search, pre-emptively filling out multiple, possible search terms at three characters in. We love how it integrates with other apps on your phone, opening tabs in the background rather than taking you out of the app you're using. And the add-ons that can augment your browser are easy to bolt on. However, it'll eat up your RAM compared to Chrome, chewing up 300MB compared to 212MB — but for the speed and convenience, it's worth the cost to your silicon. **Paul Taylor**

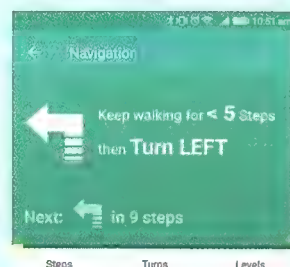
Path Guide

Geomagnetic breadcrumbs.

FREE | MSPG.AZUREWEBSITES.NET



Path Guide was made by Microsoft Research Asia as an exercise in mobile computing and intelligent perception, and it essentially does what it says on the tin — and in a very impressive manner. This app uses geomagnetic data along with your phone's other sensors to trace the indoor path that the user walks, then converts this into what's known as a "reference trace". You can either share this reference trace with friends by uploading it to the cloud, or use the trace to follow the path back the way you came. Unfortunately, our phone doesn't have a barometer and so the level changes (ie, up and down floors) weren't recorded when we tested this app, but everything else was surprisingly accurate, give or take a few steps. The app is in early stages, so we can expect some future refinement, and you can accommodate for any other slight discrepancies with the ability to annotate your journey with text and photos. Beyond being a neat experiment, this app could prove very useful for explaining to a visitor where your offices are... or just finding your car in a parking lot. **Harry Domanski**





Linux » OPEN-SOURCE SOFTWARE

Shotcut

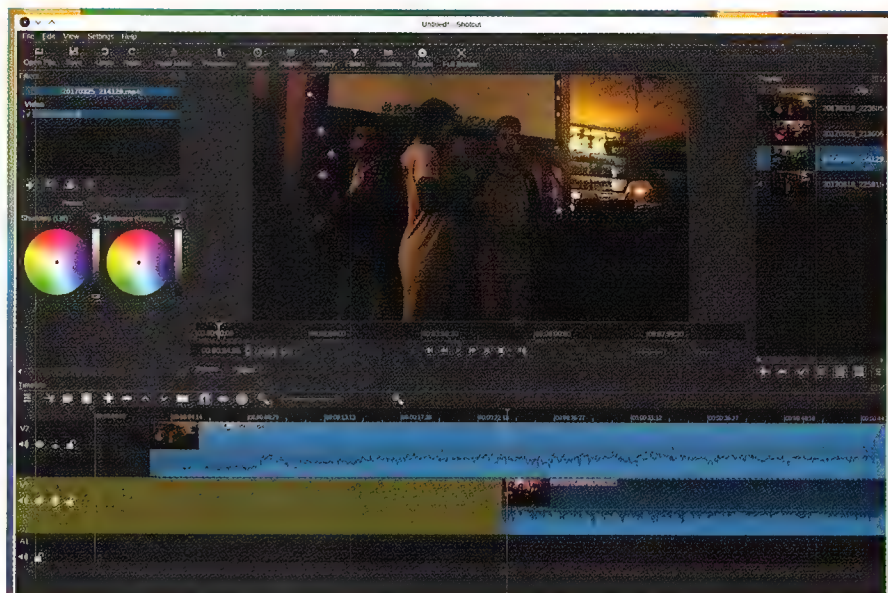
A video editor with a great range of features.

FREE | SHOTCUT.ORG

Exploring the world of open-source creative software quickly reveals that there's a visible demand for non-linear video editing. Regardless of the way people use such software, the number of available titles keeps growing, and already includes such respected names as Kdenlive, OpenShot and Flowblade. But there's another application that we undeservedly missed: Shotcut.

In the endless line of 'shots' and 'cuts' software, this new editor combines simplicity with a decent set of features, and we're sure it will attract devoted users that find other editors too complicated or basic.

Shotcut offers a neat and compact Qt5-based interface, and makes use of such technologies as FFMpeg, MLT, x264 and LADSPA, as well as various encoders. The list of supported features has much in common with Kdenlive, but we want to point out interesting elements, like native video editing without the need to import clips beforehand. In Shotcut, you just open one or several clips as you'd want



to do in a video player, and work with them directly.

The app's developers have their own vision of the comfortable and intuitive workplace. Most of Shotcut's features are available from the main toolbar, which can show and hide such panels as Filters, Timeline or file properties. By default, Shotcut shows no panels, so after the first launch, you're forced to enable things that you're going to use, such as adding video and audio tracks, and arranging panels to your liking. It looks easier than it sounds, and Shotcut is often said to offer a steep learning curve for novice users.

In other regards, we tried the experimental GPU processing option under the Settings menu. This feature is not stable yet, but it works very nicely on many modern video chips. In a real video editing workflow, GPU acceleration can save you many hours and some money on electricity when rendering large projects, so if this is the case, you should give Shotcut a try.

The project releases new milestones each month, and is constantly improving in terms of stability and translations.

Alexander Tolstoy

Rapid Photo Downloader

An image tool to help you get on top of your photos.

FREE | DAMONLYNCH.NET/RAPID

This one is a very helpful tool for Linux photographers and anyone who deals with large numbers of images. Keeping an image library well organised may not sound too difficult, but this changes once you have thousands of files.

Rapid Photo Downloader (RPD) aims to simplify downloading and sorting files from your digital camera or smartphone. In short, it automatically scans your remote USB devices and quickly generates preview thumbnails for graphic and video files. Then it lets you download files and arrange them in date-based folders.

At first glance, this is nothing really special, as dedicated photo managers such as Digikam or Shotwell have exactly the same features, but RPD can still occupy its niche. The number-one advantage is that it endows you with a strikingly fast yet powerful desktop Linux photography solution, since you may want to get rid of heavyweight photo managers entirely and explore your collection with your favourite file manager.

The top left corner of the app's window shows switchers for automatic scanning of removable media, as well as your local file system. The right-panel displays the free space details on the currently selected device, and displays a proposed directory layout where your images and video files will be stored after they are imported. This is a perfect dry run that lets you change settings and naming convention before you actually download anything.

But having shared these benefits, we still think it has something more to offer. Go to the Preferences menu (under the hamburger icon) and navigate to the Automate section. Here, you can tell RPD to download your photos and videos after you plug your device in, unmount or eject your media after the download process is complete, and more.

The more you work with RPD, the more advantageous it will be for you.

Alexander Tolstoy

Ryzen Threadripper CPUs aren't just big on core count, they're physically huge, too!



AMD tears up the high-end CPU rulebook

After years of Intel dominance, AMD is back with a true top-end multi-threaded beast in the form of Ryzen Threadripper.

Josh Collins dives deep into the nuances of AMD's latest Zen-based CPUs.

The Big Boy of the Ryzen product range has finally landed in the APC lab! The Threadripper 1950X and 1920X have been put through the rigors of our testing, along with three AMD X399-based motherboards from ASUS, Gigabyte and MSI. Before we get to those, however, let's take a closer look at some details for AMD's new CPU, what it brings to the market and the impact felt by the performance and opportunity presented against the Blue Giant competition.

The AMD X399 chipset paired with a Ryzen Threadripper CPU heralds the introduction of AMD's first high-end desktop (HEDT) platform. The market was first created by Intel utilising the X58 chipset and associated CPUs

utilising technology and architectural fundamentals drawn from the server product space. The HEDT concept introduced high core counts, and increased memory channels and density, platform I/O resources, as well as performance for workstation-type workloads compared to previous consumer-orientated platforms (P45 and X48, followed by P67/Z68). Paired with the ability to support extensive multi-GPU configurations, the HEDT platform direction created the origins for a high-end experience that would be further refined and defined over almost a decade and numerous platform generational updates.

TO DIE FOR

After years of effectively no HEDT

competition, AMD has now entered the fray with the Ryzen Threadripper and X399, utilising CPU architecture derived from AMD's Epyc server range. The Epyc processors utilise a four-die structure, interconnecting dies based on the Zen micro-architecture. This structure delivers 8 cores/16 threads, two memory channels and 32 PCIe lanes per die for a subsequent potential total of 64 cores/128 threads, eight memory channels and 128 PCIe lanes available for Epyc 1P solutions.

With Threadripper designed as a 1P HEDT platform with quad-channel memory, the Epyc processor design has been applied to the Threadripper rollout but with two dies disabled. This creates a maximum potential of 16 cores/32 threads, quad-channel memory support



Threadripper CPUs come in premium packaging, complete with a torx driver for securing the CPU socket and a bracket supporting the majority of recent Asetek-based all-in-one water coolers.



The rollout roadmap for premium desktop solutions (ie, everything above APUs) is now complete with the arrival of the Ryzen Threadripper.

AMD defines the HEDT market into a number of usage scenarios and associated types of users.



and 64 PCIe lanes. This spec is found in the product-range-topping Ryzen Threadripper 1950X. The 1920X has a lowered core and thread count of 12 and 24, respectively, but retains the overall platform resource availability of quad-channel memory and 64 PCIe lanes. Launching slightly later will be the 8-core, 16-thread 1900X.

CREATOR MODE VS GAME MODE

These modes are two software-set functions for the Threadripper range implemented via the AMD Ryzen Master Threadripper Edition software. The need to differentiate between two modes was developed during pre-release R&D as in-house testing revealed there was an install-base of gaming titles that, due to the way the game code was developed, may have performance deficits when addressing a broad memory and core architecture along with either working better with a lower core count or demonstrating a hard limit that can't be exceeded (ie, >20 processing threads).

Creator Mode essentially delivers CPU specs as per the originally intended design for Threadripper with resources distributed across the cores, and all cores and threads readily available for any workloads to be crossed between the processor dies utilising the Infinity Fabric. The Infinity Fabric, in layman's terms, is an internal communication architecture interconnecting processor resources present on the AMD Ryzen SoC design and interacts with the AMD SenseMI technology. Essentially, the Infinity Fabric and SenseMI are the brain and nervous system behind the computational heart of the processor.

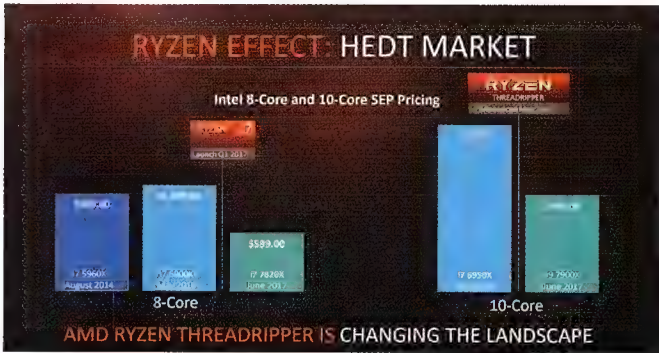
Game Mode disables half of the available core and thread count, but does so in a rather neat and clever way – using a switch in the easily navigated Ryzen Master software suite, that then requires a system reboot. Contrary to initial logical conclusion, the cores (and thereby threads) are not physically disabled to achieve this drop in core and thread count; nor is simultaneous multi-threading (SMT) disabled. The reason for this approach is that physical disablement would remove platform resources delivered by the die, such as memory channel, USB and PCIe allocations, and removing SMT would also be a detrimental move on the overall performance.

To circumvent the loss of resources and performance via disabling cores and SMT for Game Mode, what Ryzen Master is doing is issuing a BCDEdit command to the operating system configuration registry and changing the numproc value. This eloquent solution lowers the perceived (and functional) core and thread count, without negatively impacting SMT functionality or processor die resources, while circumventing the problem presented by some gaming titles. Bravo, AMD, for creating a simple, clever workaround for the end user and delivering a functional choice.

I/O YOU

Pitched as “Unlocked. Unrestrained. Uncompromised.”, AMD was seemingly going for a big impact, and perhaps even Intel's throat, especially given the frosty reception of the specs for Intel's heavily segmented X-series product stack recently launched on the X299

AMD's pulling no punches in how it intends to position its products versus the high-end Intel options.



platform. Unlike Intel's X-series processors that see desirable HEDT CPU product specs costing an arm or a leg, by comparison, AMD's Threadripper range provides the same platform resources from the baby 1900X through to the monstrosity that is the 1950X.

This means the same 64 PCIe lane allocation from top to bottom, support for high-density quad-channel memory and high core counts across the board, ranging from 8 (1900X) to 16 (1950X) with doubled thread counts, creating a truly functional HEDT system, can be done without adjusting for resource allocation compromises. For example, a system spec can be created that features a 4-way GPU solution, multiple M.2 NVMe SSDs in RAID, USB3.0 and 3.1 support, numerous SATA HDDs, and other related resources that utilise PCIe lane allocation without adjustments due to, for example, M.2 slots removing SATA, USB or PCIe slot functionality.

RAMMING THE POINT HOME

Ryzen 7 had some RAM teething issues as the market adjusted away from an almost singular focus on Intel. These issues were tirelessly worked on by AMD's performance engineers and solutions flooded through in the weeks leading up to and following the Ryzen 7 release. Now, with the Threadripper launch, the CPU review kits were bundled with G.Skill Trident-Z RGB DDR4-3200 C14 4 x 8GB kits to seemingly prove a point. And they did. The platform runs effortlessly with 32GB of quad-channel memory operating at DDR4-3200 14-14-14-34 and at a tight 1T command rate – well done! ■

AMD & INTEL HEDT PROCESSORS COMPARED					
	AMD RYZEN THREADRIPPER 1920X (DDR4-2666C14)	AMD RYZEN THREADRIPPER 1950X (DDR4-2666C14)	AMD RYZEN TR 1950X (4GHZ ALL-CORE OC / DDR4-3200C14)	CORE I9-7900X (STOCK DDR4-2666C14)	CORE I9-7900X (4.5GHZ DDR4-3200C16)
PCMARK 8 - HOME (ACCELERATED)	4,298	4,139	4,390	5,169	5,376
HWBOT X265 BENCHMARK (1080p AVERAGE)	38.05	41.18	47.00	42.57	47.07
HWBOT X265 BENCHMARK (4K AVERAGE)	7.15	7.85	8.72	7.45	8.40
CINEBENCH R15 - OPENGL (FPS)	116.85	118.89	117.83	125.20	162.20
CINEBENCH R15 - CPU (MULTI-THREADED)	2,421	2,999	3,376	2,167	2,473
CINEBENCH R15 - CPU (SINGLE-CORE)	167	167	165	194	198
CRYSTALDISKMARK 5 - SEQUENTIAL READ (Q32TI)	3,400	3,401	3,401	2,942	2,947
CRYSTALDISKMARK 5 - SEQUENTIAL WRITE (Q32TI)	1,931	1,941	1,941	1,939	1,831
3DMARK (2013) - FIRE STRIKE EXTREME (FINAL SCORE)	12,603	12,764	12,810	13,013	12,808
FAR CRY PRIMAL (1080p AVERAGE FPS)	70*	58*	56*	48	49
* = GAME MODE USED FOR COMPATIBILITY.					

apc
HOT PRODUCT



AMD CPU

\$1,440 | WWW.AMD.COM

AMD Ryzen Threadripper 1950X

Ripping up the high-end rulebook.

Delivering a product to this market is the final piece of the desktop CPU puzzle for AMD, following the release of Ryzen 7, 5 and 3 on the AM4 socket. Now with arrival of the TR4 socket and the Ryzen Threadripper 1950X, featuring 16 cores, 32 threads, quad-channel memory, 64 PCIe lanes and extended frequency range (XFR) of 4.2GHz, AMD hasn't just entered the arena, it's thrown down a challenge to the reigning king, Intel.

There are unique characteristics both for and against when assessing the comparison of the 1950X versus its similarly priced competitor, the Intel Core i9-7900X. Intel's offering sounds different enough on paper. Starting with 10 cores and 20 threads in the 7900X, it is comfortably behind the 16 cores and 32 threads counted in the 1950X. But it's not all about core count, as the 7900X delivers higher potential

clock speeds and improved per-core processing efficiency. On the flip-side is the significant difference in core count lending the 1950X increased performance in heavily multi-threaded workloads.

Judging by the benchmark results, if you do multi-threaded work but still see high value in per-core efficiency, the Intel may be the better choice – though, this appears to depend on how well the game code handles nT processing. If your computing focus is production orientated, such as audio engineering, video editing, gaming and streaming simultaneously, 3D modelling and so on, the high core count of the 1950X brings it victory.

■ Josh Collins

Verdict

A well-featured and versatile CPU that feasts on multi-threaded workloads.



apc
HOT PRODUCT



AMD CPU

\$1,150 | WWW.AMD.COM

AMD Ryzen Threadripper 1920X

A less-costly way to tear it up.

You may not look upon this \$1,150 processor as a good value proposition.

However, within the scope of a HEDT system and in comparison with the Intel Core i7 and i9 X-series range, perhaps even its stablemate the 1950X, the Ryzen Threadripper 1920X actually presents good value for money with broad spec capability and performance that marginally shadows the faster Core i9-7900X and 1950X, while a step ahead of the i7-7820X.

Considering the 1920X's price, this unit slots into the market in a gap between the Core i7-7820X and Core i9-7900X. In per-core performance, the Intel solutions are faster, but the overall package presented by the 1920X at \$1,150 is an attractive offering in comparison with the Intel Core units. The Ryzen Threadripper 1920X brings 12 cores and 24 threads to the bout, eclipsing both Intel options within range.

The higher core count does assist the 1920X in matching or exceeding the 7900X in heavily multi-threaded workloads; however, the ability to push high frequencies with the 7900X ultimately makes it the faster option overall. However, taking that option is more costly and neither Intel options can match the platform I/O resources available on AMD's X399 Threadripper platform.

Nestled right in the sweet spot of price, performance, platform resources and I/O, equipped to handle the appropriate workloads for a HEDT platform, AMD's new 1920X presents exceptional value for money for a high-end processor and PC.

■ Josh Collins

Verdict

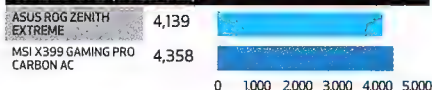
A CPU costing over \$1,000 that presents solid, good value. Whodda thunk it?



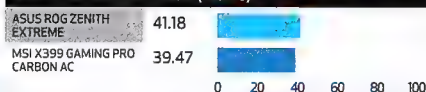


LABS BENCHMARK RESULTS

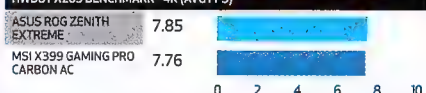
PCMARK 8 - HOME (ACCELERATED)



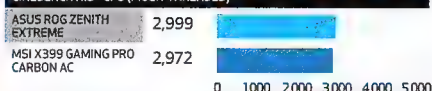
HWBOT X265 BENCHMARK - 1080P (AVG FPS)



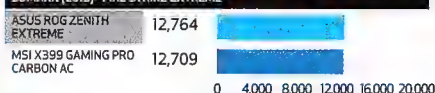
HWBOT X265 BENCHMARK - 4K (AVG FPS)



CINEBENCH R15 - CPU (MULTI-THREADED)



3DMARK (2013) - FIRE STRIKE EXTREME



FAR CRY PRIMAL (1080P, AVG FPS)



ASUS RoG Zenith Extreme

The price may be pointy, but this truly is a board that's at the top of its game.

The word 'zenith' describes a point at which something is most powerful or successful. It seems, then, that this motherboard, the RoG Zenith Extreme is fittingly named.

Leading a tight race through this month's X399 benchmark suite, the Zenith delivered a consistently positive user experience from start to finish. As the only offering in the trio of boards tested that fits the Extended-ATX form factor, or 'EATX', the Zenith has extra precious PCB space upon which to mount and engage additional features. Perhaps a little unusual is the comparatively fewer M.2 slots mounted near the PCH and between PCIe slots, with a single port hidden beneath part of the PCH heatsink for passive cooling. With the Gigabyte and MSI X399s both sporting three M.2 slots each, the Zenith looks a little sparse for NVMe SSD support by comparison. That is, until you notice the DIMM.2

solution developed and integrated by ASUS, which provides an alternative mounting for a second M.2 drive via a custom daughter-board, and further rounding out NVMe SSD support with a U.2 port – something both the Gigabyte and MSI options lack. Depending on your storage needs, this approach could be either a positive or a negative.

The Zenith design takes a number of different routes to the competition. For example, the RoG engineers didn't deem it necessary to include eight SATA 6Gbps ports, opting instead for just six. For some storage-oriented owners, this may be a shortcoming, but for others, it means resources can be allocated elsewhere.

Many of the strengths and intriguing attributes of the Zenith aren't typically caught on the first look – but rather the second or third pass – requiring some thought and consideration as to whether this board will be appropriate and suitable for your needs.

For extreme performance buffs, especially those that like to dabble in exotic cooling solutions and high overlocks, the Zenith is packed with additional OC-focused features. These type of board features and capabilities are actually common to ASUS's RoG Extreme range, and offer attributes like PCIe slot dip switches, LN2 mode, PCB-based voltage measuring points for digital multi-meters (DMMs) and connectivity for peripherals like the RoG OC Panel. However, it's worth noting that this Extreme series 'board doesn't come bundled with that now-discontinued OC Panel, so you'll have to already own one or search the second-hand market.

At almost \$250 dearer than the next board in the ranks, some may cringe at the price. However, if you're building a system that can properly take advantage of what the platform offers and use the bundled extras, there is value to be found. Though admittedly that'll

differ on a case-by-case basis. Examples of this one's rarer bundled extras include parts like 2-, 3- and 4-way SLI bridges (while competitors only include a 2-Way bridge), a fan controller card for an additional three 4-pin fan ports, and the RoG Areion 10G PCIe x4 add-in card, that delivers 10Gbps Ethernet connectivity. The Areion 10G alone sells for a touch over \$200 in the ITC channel. Oh, and it rocks 802.11ad Wi-Fi support, too!

Overall, the Zenith offers a pleasant user experience, with good performance and a welcoming aesthetic.

Josh Collins

Verdict



It's expensive, but if you're going to utilise those features, the price is justified. Solid user experience, too.





AMD X399 MOTHERBOARD

#619 | WWW.GIGABYTE.COM.AU

Gigabyte Aorus X399 Gaming 7

Maintaining a solid run for Aorus, this time on a new frontier.

The Aorus X399 Gaming 7 is perhaps the best point of entry to Ryzen Threadripper ownership out of the three boards we tested for this roundup, based on the price point compared to featureset and user experience. Having said that, it's a very tight race and we can see end-users being happy with any of the three.

The Gaming 7 presents well with a sleek muted colour palette, accented by metallic highlights in both the VRM heatsinks and the expansion slot reinforcements. This contrast of matte surfaces and metallic lustre leads to a visually appealing and pleasant aesthetic.

Furthermore, if lighting bling is your thing, the Gaming 7 comes packed to the brim with RGB LED integration across the DIMM slots, PCIe slots, PCH heatsink, audio component cover and rear I/O shield — essentially everywhere you could

hope to experience millions of colours.

Like its Aorus cousins, the primary network connection — the sole Ethernet port — is driven by a Killer E2500. While we prefer the Intel I211-AT found on competitor offerings, we didn't experience any show-stopping issues with the Killer E2500. Wireless connectivity is delivered by a 2T2R Intel Dual Band Wireless-AC 8265 wireless NIC connected via M.2 and integrated into the motherboard's rear I/O panel. This isn't a new 802.11ac solution and has been seen previously on models from a range of motherboard vendors, but it is a proven capable wireless-AC solution that gets the job done and with minimal fuss.

System I/O is plentiful, featuring a plethora of USB connectivity both on the rear I/O panel and via internal headers for front panel options, sporting both Type-A and Type-C connectors. Storage options

are maxed out by support for three M.2 drives, with two slots for 22110 spec NVMe SSDs and one slot for 2280 spec, and support for RAID 0, 1 and 10 options. This is backed by eight SATA 6Gbps ports, rounding out strong storage support.

Interestingly, Gigabyte continues to be the sole proprietor of motherboards with RGBW connectivity, with the Aorus X399 Gaming 7 supporting two such connections for RGBW LED ribbons.

Audio is driven by the Realtek ALC1220 codec, a component we've seen an abundance of throughout motherboard launches in 2017. However, it's the extra supporting components, such as the WIMA FKP2 and Nichicon Fine Gold capacitors, along with additional supporting driver software that assist in lifting the Realtek ALC1220 from being 'just another onboard audio codec'.

In the overall rankings of the APC Labs test results, the Aorus offering brought

up the tail, but with a spread of only three points in the podium grand totals (from 21 to 24), the range of difference is slim to say the least. Yet, it is worth noting that the Gaming 7 was particularly proficient at the HWBot X265 4K benchmark, but traded blows with both the ASUS and MSI offerings throughout the suite.

Don't be put off by the fact this motherboard ranked third overall in our test results, as there's only a slim difference and, for the price, the performance and features delivered here are still exceptional.

■ Josh Collins

LABS BENCHMARK RESULTS

PCMARK 8 - HOME (ACCELERATED)

GIGABYTE AORUS X299 GAMING 7	4,305	
ASUS ROG ZENITH EXTREME	4,139	

HWBOT X265 BENCHMARK - 1080P (AVG FPS)

GIGABYTE AORUS X299 GAMING 7	40.76	
ASUS ROG ZENITH EXTREME	41.18	

HWBOT X265 BENCHMARK - 4K (AVG FPS)

GIGABYTE AORUS X299 GAMING 7	8.00	
ASUS ROG ZENITH EXTREME	7.85	

CINEBENCH R15 - CPU (MULTI-THREADED)

GIGABYTE AORUS X299 GAMING 7	2,985	
ASUS ROG ZENITH EXTREME	2,999	

3DMARK (2013) - FIRE STRIKE EXTREME

GIGABYTE AORUS X299 GAMING 7	12,704	
ASUS ROG ZENITH EXTREME	12,764	

FAR CRY PRIMAL (1080P, AVG FPS)

GIGABYTE AORUS X299 GAMING 7	59	
ASUS ROG ZENITH EXTREME	58	

Verdict

Features	★★★★★
Performance	★★★★★
Value	★★★★★

Well featured at a strong price point, the Aorus is a greater pairing for either the 1920X or 1950X.



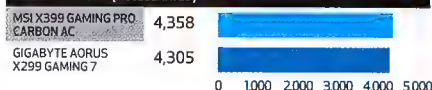


AMD X399 MOTHERBOARD

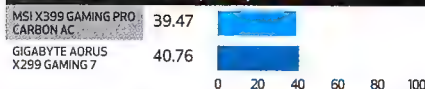
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LABS BENCHMARK RESULTS

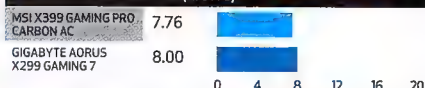
PCMARK 8 - HOME (ACCELERATED)



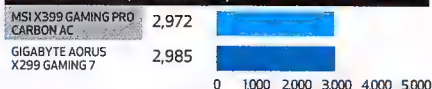
HWBOT X265 BENCHMARK - 1080P (AVG FPS)



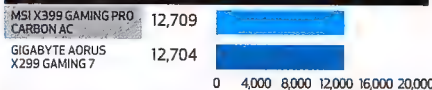
HWBOT X265 BENCHMARK - 4K (AVG FPS)



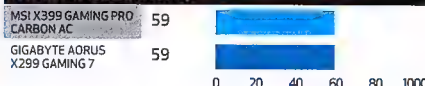
CINEBENCH R15 - CPU (MULTI-THREADED)



3DMARK (2013) - FIRE STRIKE EXTREME



FAR CRY PRIMAL (1080P AVG FPS)



MSI X399 Gaming Pro Carbon AC

MSI's quest to differentiate has actually driven some innovation.

The X399 Gaming Pro Carbon AC is the final center in this roundup and it really reinforces the fact that, as PC enthusiasts, we're living in an era where we're spoilt for choice. Not only is AMD competitive again with Intel across a range of areas, particularly with high-end desktops, but the motherboards to support the new Ryzen Threadripper CPUs are consistently of high quality. This scenario has delivered choice to the end user and further increased the competition in the market — a welcome combo.

With RGB LED illumination having penetrated nearly every aspect of PC component production, it's no surprise that motherboard designs are now typically muted with metallic highlights. Though we prefer the industrial influence of the Aorus board, the MSI X399 Gaming Pro Carbon AC introduces a novel way to customise the motherboard

aesthetics beyond RGB LED illumination. This board features three plastic plates screen-printed with a carbon visual effect; however, these units can be removed and replaced with bundled metallic gold or silver plates according to the tastes of the end user. There's also potential here for PC modders to get creative with custom painted plates, repurposing the units provided for a further personalised flare.

On the RGB lighting front, the X399 Gaming Pro Carbon AC is adorned with RGB illumination on the shield above rear I/O, audio component shield, PCH heatsink and a light bar on the lower half of the right-side PCB edge. This combination of lighting outlets provides sufficient accents to present the end user's build with coloured luminance. Also on the RGB LED front are two RGB headers. One of these supports the use of the established 5050 spec RGB LED ribbons while the

second header provides similar RGB LED ribbon support for the smaller 3528 spec LEDs (3.5mm x 2.8mm diode). This is the first time we've seen support for 3528 spec LED ribbons and question the proliferation of use of these lighting strips, but modders do enjoy choice, so time will tell how this split approach is received by the market.

The Carbon AC series has historically implemented an 802.11ac wireless solution placed on the rear panel I/O, hence the AC moniker. Indeed, the X399 Gaming Pro Carbon AC does sport 802.11ac Wi-Fi via the Intel Dual-Band Wireless-AC 8265 wireless network interface controller (WNIC), though unlike the back panel I/O implementation of the same WNIC on the Aorus offering, the MSI solution is presented as a PCIe x1 daughterboard, with the Intel 8265 card needing to be installed via M.2.

This creates a potentially messy (or impossible) usage when considered with 3- and

4-way multi-GPU setups. We would have much rather seen a similar integration to that found on the Aorus.

In terms of performance, the MSI X399 Gaming Pro Carbon AC edged out the Aorus offering to claim second place, two points behind the leading RoG Zenith Extreme.

However, the differences across the range in performance experienced at standard settings was minimal, making features, layout, aesthetics and unique implementations a more significant set of assessment criteria to be addressed.

■ Josh Collins

Verdict

Features
Performance
Value



Unique attributes like changeable plates and 3528 LED ribbon support may be enough to win you over.



HAVE YOU BEEN HACKED?

THE EXPERT GUIDE TO SECURING YOUR DIGITAL ECOSYSTEM: WINDOWS, MAC, ANDROID, ONLINE & MUCH MORE

PLUS, **PROTECT YOUR PRIVACY:** LOCK DOWN FACEBOOK • GHOST GOOGLE • STOP WINDOWS 10 SPYING



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SECURE YOUR DIGITAL ECOSYSTEM

We reveal the tips and techniques you need to lock down your entire digital ecosystem.

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THE BEST WINDOWS SECURITY SUITES

We uncover the best security suites for all types of Windows users.

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SECURITY ON ANDROID

Everything you need to know about securing your Android phone or tablet.

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SECURITY ON MAC

How to stay safe when using your Mac at home or on public Wi-Fi hotspots.

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LOCK DOWN FACEBOOK

Facebook is great for sharing, but it's easy to overshare — it's time to control who sees what.

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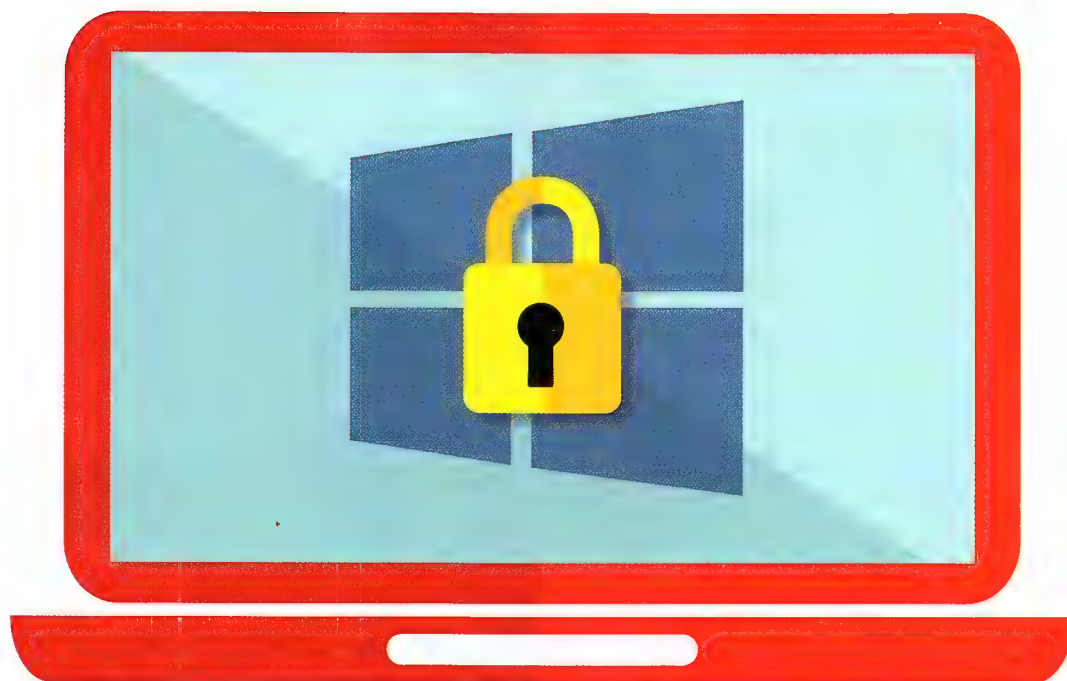
GIVE YOURSELF A GOOGLE PRIVACY CHECK

How to stop Google from tracking your online activity.

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STOP WINDOWS 10 SPYING

The Creators Update has changed-up Windows' privacy options again, so we show you how to lock them down.



Secure your digital ecosystem

Worried about your online and offline security and privacy? Nick Peers reveals the tips and techniques you need to lock down your entire digital ecosystem.

There's hardly a day goes by without some new hacking controversy. From online sites getting compromised to people facing down ransomware demands, the always-connected era is one fraught with danger. Prevention is always better than cure, so what can you do to ensure you're as protected as you can be?

In this feature, we're going to arm you with all the tools, tips and guides you need to close the door on drive-by hackers, malware and other online threats to your privacy and security. We'll start by locking down your PC — ensuring your security software is up

to scratch, you have a firewall that's fit for purpose and that your personal data is encrypted and as difficult to steal as possible.

Next, we'll look at tightening the security of your home network — you'll discover how to log on to your router, improve the security of your Wi-Fi network and restrict access to only those devices you explicitly choose. We'll also show you how to perform a quick security sweep of your wireless technology and check it for weak spots.

Then it's on to your internet connection — you'll learn how to encrypt your connection using a VPN,

even when browsing in public spots, and discover how to engage in secure web browsing, email and even chat. Last, but not least, you'll learn how to implement a foolproof — and watertight — password management system to ensure you have unique, strong passwords without making things awkward. We'll even show you how to switch on two-factor authentication for even greater protection.

Follow these tips and you'll lock out the snoopers and hackers, and keep your personal data as private and protected as it can be. It's time to fight back.

Secure your cloud backups

If you back up data to the cloud, you may be concerned about its security.

All cloud providers promise to encrypt your data for privacy purposes, but what kind of encryption is provided, and where are the keys required to decrypt your data stored? If you're at all paranoid, you will want those keys kept in your personal possession, a technique which is known as client-side encryption. Sadly, not many cloud backup providers offer this — neither Dropbox nor OneDrive do, for example.

If this is a concern, you can encrypt your data locally before uploading it

to the cloud — if you're already using VeraCrypt, for example, you could simply create an encrypted volume inside your cloud folder and store all sensitive data in there. On the other hand, if you primarily use your cloud provider for syncing data between your various devices, you'll need to choose a solution that enables you to access your data on whichever platforms you need.

There are a number of options out there, but one that's unlimited and free for personal use is nCrypted Cloud

(www.encryptedcloud.com/apps/windows). Once installed, set up your free nCrypted Cloud account, then connect cloud providers (Dropbox, OneDrive, Box and Google Drive are all supported) and finally choose the folders that you want to encrypt. If you want access from other computers or mobile devices (Mac, iOS and Android are also supported), then simply install the relevant app or program, link it to your nCrypted Cloud account and you're done.

Tighten up your Windows security

Step one in protecting your home starts with your own PC.

Let's begin by tightening the security of the computers in your home. First, take a look at your security software. If you're currently using Windows Defender, we recommend that you switch to something stronger. If you're happy to rely on free protection, then Avira Free Security Suite (www.avira.com) is an excellent choice. It's light on its feet, easy to use and gives you protection that matches many commercial products. It includes anti-malware, system tune-up, a cloud-based password manager, secure browsing, a volume-limited VPN, web and search filter, as well as a software update checker. Plus, you can manage multiple devices from a single desktop. (For more information, check out our full review on page 58.)

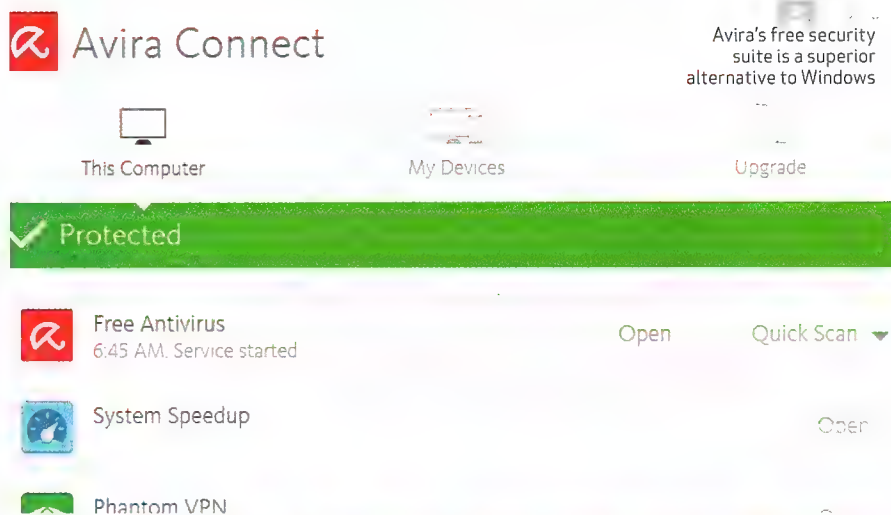
Paid-for protection from the likes of Kaspersky, Symantec and Norton goes even further, and you can get discounts by buying multi-computer licences to cover your whole household. If going down this route, keep an eye out for frequent deals — you can purchase these any time of the year, then apply them once your subscription has run out.

SECURE YOUR FIREWALL

If you decide to use free protection, you'll be relying on the Windows Firewall. It has all the tools you need to close the door to hackers, but it doesn't use them fully. Windows Firewall monitors incoming traffic from your network and the internet for potential threats, but waves through all outgoing traffic from applications without a second thought.

If you don't have a third-party firewall installed, then TinyWall (tinywall.pados.hu) gives you a way to use Windows Firewall as a two-way firewall. True, it needs a bit of configuration to get working, but our step-by-step guide on the opposite page reveals all. The only caveat is that it can take some time before all your software is working correctly — look out for failed updates and applications complaining about not having enough access. If you recognise and trust the app in question, simply follow the guide to add it to TinyWall's whitelist.

Also note the potential issues with sharing files and printers with other people — you can work around most of them, but if it's too much



"If you decide to use free protection, you'll be relying on the Windows Firewall. It has all the tools you need to close the door to hackers, but it doesn't use them fully."

hassle, look for a paid-for solution instead.

ADD MORE PROTECTION

Whatever security software you have installed, there's always room for extra help. You can start by installing Malwarebytes Anti-Malware Free (www.malwarebytes.org), which can root out and remove infections missed by your main security software. The free version should be used to scan your system at least once a week, or pay for the Premium version for real-time protection (without conflicting with any of your other security tools).

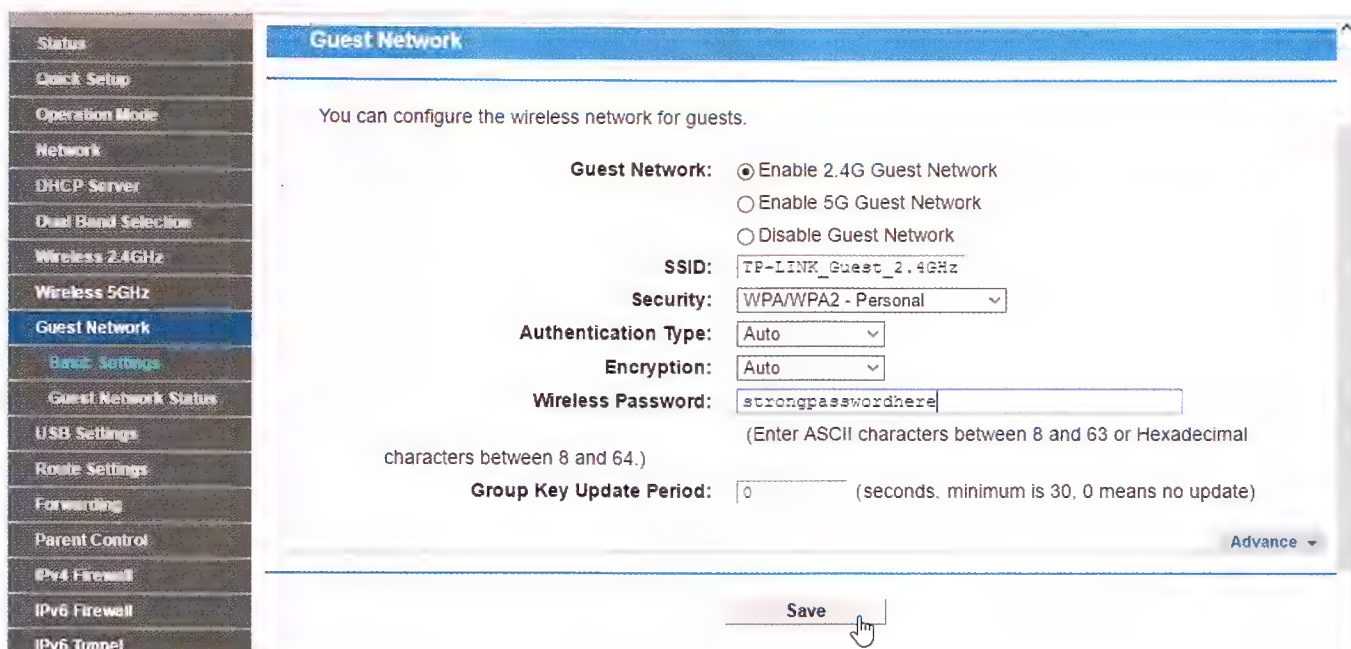
If your security software doesn't offer any protection against ransomware, then install BitDefender Anti-Ransomware Tool (www.bitdefender.com/solutions/anti-ransomware-tool.html) to block four known ransomware families. Ransomware is particularly nasty malware that encrypts all the data on your hard drive, demanding you pay a hefty ransom in return for the key required to unlock it — which also relies upon the honesty of the criminal behind it. Another way to protect yourself is to regularly back up your data both offsite (the cloud) and onsite (an external hard drive).

PROTECT YOUR DATA

Personal files are priceless, but they're also sensitive. If you're a laptop user who takes their PC on the road, you should ask yourself how you would feel if your laptop was stolen. The answer is to encrypt your files, and that can be done a number of ways depending on where the data is stored.

If you're carrying files on a USB thumb drive, the easiest way is to create an encrypted 'container' into which you place your most sensitive files. The container is password-protected — supplying the correct password unlocks the files within as a virtual disk drive, but otherwise, they remain hidden and scrambled. If this approach appeals, take a look at Rohos Mini Drive (www.rohos.com/products/rohos-mini-drive). This lets you to create virtual drives up to 8GB in size for free.

If you want to encrypt your entire machine, then Windows 10 Professional users should type "bitlocker" into the Search box to find out how to use Windows' own encryption tool. If you're running Windows 10 Home, then use VeraCrypt (veracrypt.codeplex.com). You can use it either to create encrypted volumes of locally-stored data or encrypt entire drives and partitions — see the 'System Encryption' section of VeraCrypt's documentation.



Lock down your network

Stop hackers and snoopers from accessing your router.

Even if you've yet to embrace the concept of the smarthome, the chances are you will still have a number of devices, as well as your PC, competing for bandwidth on your home network. Read on to discover how to reduce its vulnerability with a home network security audit.

LOCK YOUR ROUTER

Let's start with the gateway between your home and the internet. If you've never carried out admin on your router before, then you will definitely find ways in which to strengthen its security. You can usually manage your router through your web browser by entering its four-digit IP address into the Address Bar. To do that, first open 'Settings > Network and Internet' and click 'View your network properties', then make a note of your router's IP address under Default Gateway.

Type the IP address into your browser, and you will now see a status or login page. Each router handles things differently, but they all follow a broadly similar pattern. Consult its documentation, look on the router box or visit its support website for the default login details to gain access.

It's possible for drive-by hackers to target routers remotely, relying on users having left the default password in place, so if that's the case on your router, you should look for the option to change this – on our TP-Link router it's under 'System Tools > Manage Control', but other routers will vary. See page 52 for tools that can help you help create a strong password.

PROTECT YOUR WI-FI

Once the router password has been

changed, it's time to tighten up your Wi-Fi network. Your router should have already set encryption (WPA2-PSK with AES encryption ideally), but it's a good idea to change the default password. Yes, you'll have to reconnect all your wireless devices, but you'll immediately kick off any unauthorised devices who might have been using it without your knowledge. If you have separate 2.4GHz and 5GHz networks set up, repeat for both (and consider setting unique passwords for each separate network).

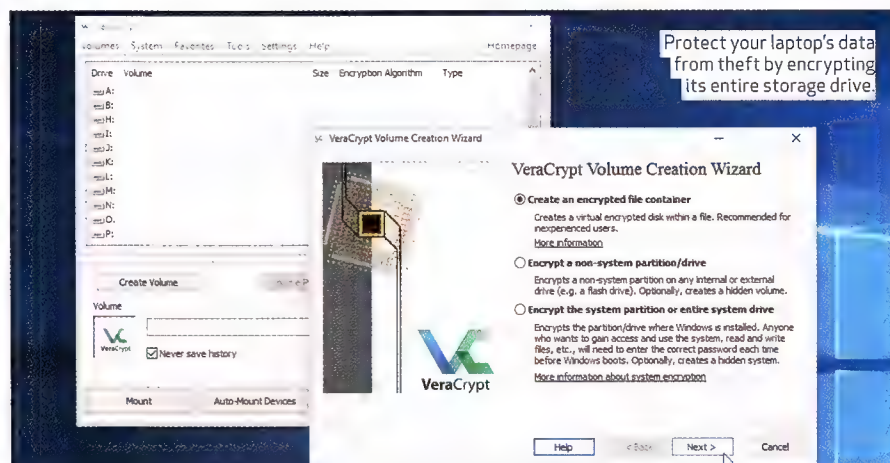
Each computer or device on your network is identified using its MAC address, a six-digit hexadecimal code. If your router supports MAC filtering, it means you can lock down your wireless network even further, by only accepting connections from devices with specific MAC addresses.

First, you need to identify the MAC address for each device you own, which we recommend you write down and record somewhere secure. You'll need to look up instructions for your specific

device, but it'll typically be under Settings somewhere. In the case of your wirelessly connected PC, look under 'Settings > Network and Internet > View your network properties' in the Physical Address (MAC) section.

Once you've got all the MAC addresses you need – including, critically, your wireless PC if applicable – enable MAC address filtering and enter the addresses one by one. If prompted, choose the option to only allow devices with MAC addresses that match.

If you frequently allow family and friends to access your Wi-Fi network, enabling MAC address filtering may be a step too far. That said, explore your Wi-Fi router's settings to see if it offers a guest network function – if it does, you can give visitors internet access without opening up the rest of your network to them. Make sure that you enable the WPA/WPA2 encryption option for the guest network, and set a unique wireless password for your guests to use.



More security settings

Your devices connect to the internet using a series of virtual ports, with different ports used by different applications and services.

Some are standardised – for example, port 80 provides connections to the web, while port 25 is used by SMTP email servers – but others are allocated on an application-by-application basis (if you want to access your Plex Media Server over the internet, for example, you need to connect through port 32,400).

In the past, you had to manually open ports through your router's setup utility, but thanks to the arrival of Universal Plug and Play (UPnP), apps can now communicate effortlessly with your router and open the ports they need in the background. While convenient, this does open your router to potential breaches (malware can open ports to wreak havoc, for instance). You should, at the very least, check periodically to see which apps have access to your router and if you don't recognise any, disable it immediately to close all ports.

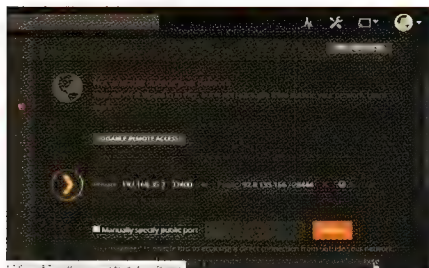
You can then investigate the dubious app further using the IP address to target the device it's originating from before deciding whether or not you should re-enable it.

A better approach – if a bit less convenient – is to manually set up port forwarding yourself. Apps should alert you when this needs to be done, and you can follow the step-by-step guide at the bottom of this page to see what information needs to be set up for each port.

One final thing: check your router's support website to see if any firmware updates are available for it. These can add more features, but may also contain security fixes. Installing an update usually involves downloading the update file to your PC, then uploading it manually to your router's configuration utility where it's then applied. Be sure to back up or record your settings before doing so, in case the update wipes them out.

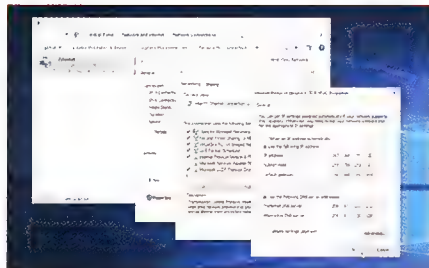
"You should, at the very least, check periodically to see which apps have access to your router and if you don't recognise any, disable it immediately to close all ports."

Open up ports manually.



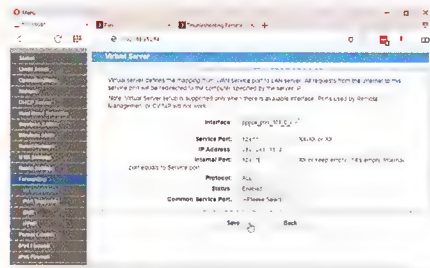
1 CHECK OUT AN APP'S INTERNET NEEDS

Any app on your computer (or other device) that needs access to the internet should make it clear what you need to do in order to open up access to it. You should start by looking into the program's own settings to find out where you determine which ports it requires and the steps you need to follow to make it work.



2 SET STATIC IP ADDRESS

If you've not already done so, you'll need to set up a static IP address for the device that is running the application. In Windows 10, you should follow the guide at portforward.com/networking/static-ip-windows-10.htm. Make sure that you give the device an IP address which doesn't clash with your router's DHCP server.



3 ADD NEW PORT

Armed with the instructions provided in from the site in Step 2, locate the port forwarding section of your router's configuration utility. Now create a new port, entering the port number into both port fields and your device's IP address into the IP Address field. Click Save or Enable to test the connection and see if it's working correctly.

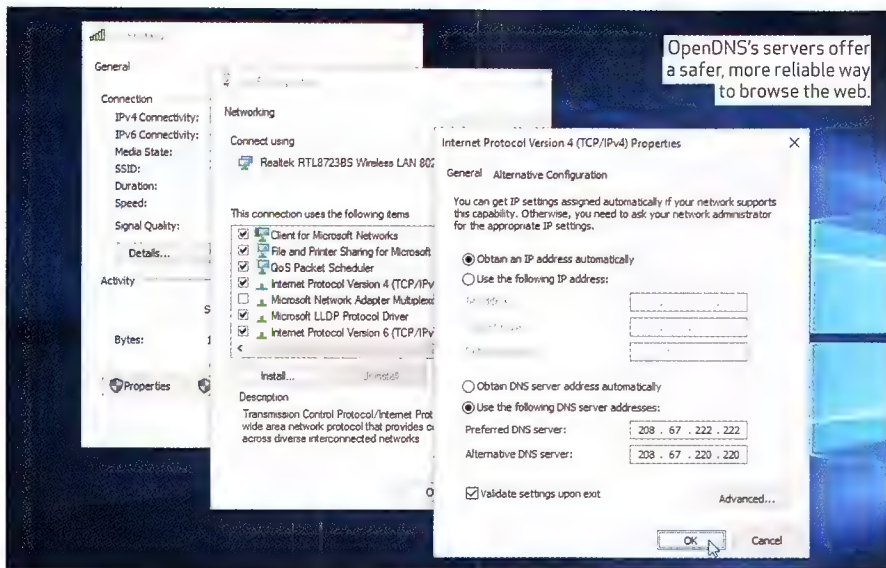
Protect home network kit

You've tightened your router settings, but what about the devices connected to your network?

The growth in smarthome tech means many more wireless devices are now communicating over the internet, so make sure these are locked down, too. We'll show you how to use strong passwords and other measures to lock down any account settings screens over the page, but you should look out for firmware updates that can help close security loopholes.

If you have a webcam attached to your PC, make sure it's not in a place where it could be used to spy on you. Keep an eye on the activity light – it should only be on when you're using it. If the camera is a USB model, consider unplugging it when not in use or at least cover the lens, so even if it is compromised, it won't see anything. If you use a security camera, protect it with a strong password and limit who has access. You should also switch on its notifications to make sure you're alerted whenever it's used.

If you'd like to see what's currently connected to your home network – potentially enabling you to spot snoopers or hackers – download and run Advanced IP Scanner (www.advanced-ip-scanner.com). It will list all currently active network devices. Use the Manufacturer field to help identify unknown devices if the name doesn't give you any clues, and keep scanning from time to time.



Protect yourself online

Boost privacy and security when using the internet.

Now let's make your internet connection more secure, starting with your DNS server. This is used to translate web addresses into their physical IP addresses. Normally, your DNS server is provided by your ISP, but it's not the best choice for performance and security reasons. Alternatives such as OpenDNS are faster, more reliable and, crucially, apply more security checks to validate web addresses. With OpenDNS, you can sign up at its website (www.opendns.com) for things like parental controls and identity theft protection.

Alternatively, log in to your router, locate where its DNS settings are stored, and then change them to the following addresses: 208.67.222.222 and 208.67.220.220. The effect will be immediate. If you lose your connection, check that you've added them correctly.

If you have any devices you use away from home, you can change their DNS settings to OpenDNS, too – in the case of a Windows 10 PC, you need to type "network" into the Search box and click 'View network connections'. Double-click your adapter's entry and click Properties, then select 'Internet Protocol Version 4 (TCP/IPv4)' and click Properties. Select 'Use the following DNS server addresses' and enter 208.67.222.222 and 208.67.220.220 into the two boxes, then click OK.

SECURE WIRELESS CONNECTIONS

When you're on the go, it's tempting to connect to any public wireless hotspot, even ones that don't ask you for a password. The problem is, these are often completely open, allowing anyone to eavesdrop on you. That's where a VPN comes in.

A VPN creates a 'tunnel' through a public network, that enables you to connect to the internet, with all the

traffic to and from your device encrypted. If you just want to browse the web, install the Opera web browser (www.opera.com), which includes its own VPN. Look for the VPN button in your Address Bar (you can enable it via 'Menu > Settings > Privacy & security'). Click it, flick the switch to 'On' to encrypt your web browsing. If you want to widen VPN support to all your network traffic, the simplest solution is to install CyberGhost VPN (www.cyberghostvpn.com), which can encrypt your entire connection. The free version is unlimited, but slow – pay the US\$10.99 monthly fee for faster performance.

MORE SECURE WEB BROWSING

Your internet connection may now be secure, but you can still do more. Opera comes with its own built-in ad blocker,

which can help you avoid adverts as well as malware, but if you are using another browser, install the Adblock Plus plugin instead.

It's also a good idea to connect securely to websites when you can, using the 'https://' protocol rather than the insecure 'http://' one. Remembering this is tricky, so install the open-source Smart HTTPS add-on, and it will try to connect securely.

Half of the trick of staying safe online lies in avoiding dodgy websites. While web browsers are smarter at detecting and diverting you from sites that are known to be dangerous, there's always room for improvement. See what web-filtering tools your security software offers in the form of a browser toolbar and use it to search the web instead of Google.

Similarly, be careful with software downloads – get them from a reputable website and scan the file with your anti-malware tool before running it. Exercise similar caution with browser add-ons – review each one before you install it, and periodically check which add-ons have been installed, removing any you no longer need or recognise.

It's a similar story with email. Avoid clicking any links and instead type the URL into your web browser directly to ensure you end up going where you think you should. You should also scan email attachments before opening them, and employ the services of tools such as Mailwasher (www.mailwasher.net) or PopTray (www.poptray.org) to screen messages before they land.

Emailing someone is akin to sending a postcard – anyone can read it. If you use Thunderbird, check out the step-by-step guide to find out how to encrypt email.

Chat securely

Do you chat securely (or not) through instant messaging apps such as Skype?

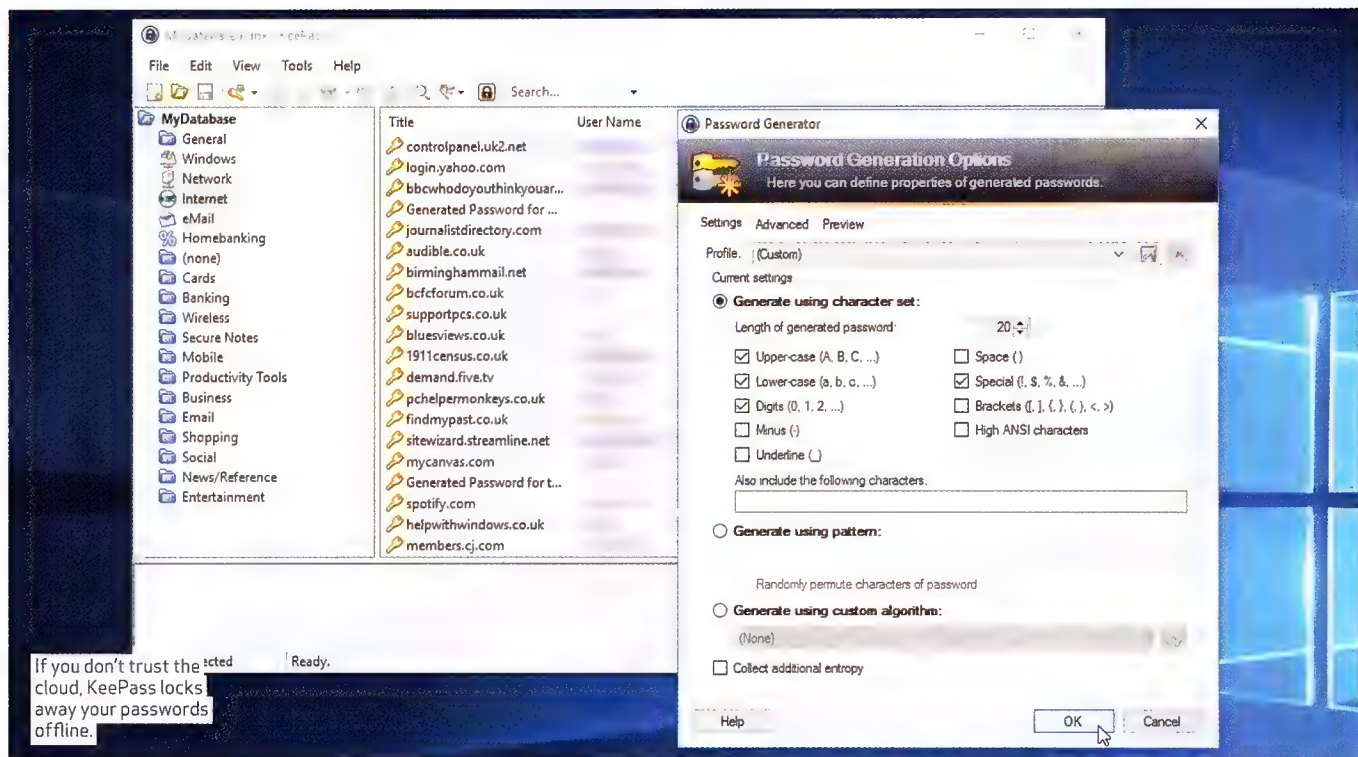
While they can be great fun, the bad news is that Skype, in particular, isn't that secure. If you want true end-to-end encryption for voice, video and text-based chats (as well as secure file sharing), then you'll need to look into using an alternative solution.

The most secure we have found is Retroshare (www.retroshare.net). The only catch is that you'll have to convince all your contacts to use it, too – if this is a deal breaker, take a look at Jitsi (jitsi.org), which supports a number of different messaging platforms.

You can install Retroshare (choose the QT5 version when at the download page) to your PC's main storage drive or run it as a portable application, then set up your account and get

each contact to do the same. You then export certificate files to send to each contact before importing their file in turn. Tick 'Authenticate friend (Sign PGP Key)' if you're confident in their identity, then wait while Retroshare's Connection Assistant sets up the connection.

It's a fiddly process getting that initial connection set up (and you have to repeat it for each device you install Retroshare on and import your identity into), but once both of you are verified and connected to the other, you can be secure in the knowledge that future chats aren't just encrypted and secure from unwanted eavesdroppers, but that you know exactly who you're chatting with.



Beef up your passwords

How to lock down your online and offline accounts.

Do you rely on a limited number of passwords to secure accounts both online and off? You're not alone. The sad truth is, though, that this represents an opportunity for hackers and identity thieves who, once they crack one of your passwords, can often crack them all.

The way to solve this problem is to create unique, complex passwords for each account that you use, using a mix of upper and lowercase characters, numbers and even symbols. The trick then is remembering them all.

The solution lies in employing the services of a password manager. A good password management tool will generate strong random passwords, make them easy to access and protect them all behind a single, strong master password you can remember. You log into the password manager with the master password, and the rest of your passwords are then available.

PICK A PASSWORD

If you're super-concerned or even paranoid about security, you'll want to store your passwords offline, in which case you should look at KeePass (keepass.info). Everything's stored locally, and you can add an extra layer of protection to your passwords by locking them using both a master password and a key file, which you store on an external disk or drive.

"A good password management tool will generate strong random passwords, make them easy to access and protect them all behind a single, strong master password you can remember."

It's portable too, so you can store everything on a USB thumb drive and take your passwords with you on to other computers.

The biggest drawback with KeePass, however, is that it only works on your PC – if you want access to your passwords on your mobile, for example, then you'll need to be within reach of your machine to access them. If you're willing to store your passwords in the cloud (encrypted, of course), a more convenient option is to use a tool such as LastPass (www.lastpass.com).

LastPass offers a similar feature set to KeePass, minus the key file option. Instead, what it gives you is more convenience – you can install apps on your devices (including mobile ones) and use browser plugins to make it easier to log into sites – see the guide on the opposite page – as well as generate strong, random passwords for new accounts. LastPass works with

any service you access through your web browser, making it a good fit for your router, plus locally hosted servers such as Plex.

LastPass also offers secure notes and form filling tools, for storing other sensitive information. You can also ask LastPass to prompt you for your master password each time you open a particularly sensitive note. It also includes a security audit, which checks all your passwords for weak ones, duplicates, passwords you haven't updated in a while and even accounts known to have been compromised.

All of this functionality – including syncing across mobile and desktop – is now completely free. Upgrade to the LastPass Premium package (US\$24 per year) for more features, such as LastApp – a tool for using LastPass in conjunction with installed apps or programs on your device.

Two-factor authentication and two-factor verification add an extra layer of security, by checking your identity using mobile devices.



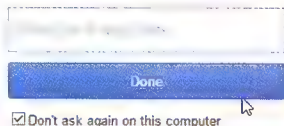
2-Step Verification

To help keep your email, photos, and other content safer, complete the task below.



Enter a verification code

Get a verification code from the Google Authenticator app



☒ Don't ask again on this computer

MULTI-FACTOR AUTHENTICATION

Even the strongest password can be guessed or cracked, so what happens if your password is leaked? The solution is to implement two-step verification or two-step authentication. This adds an extra step when logging into key accounts (including LastPass) on new devices. This can be as simple as an email notification, or you can implement a solution that requires your mobile phone or tablet to be at hand.

This latter option is best, because you'll need physical access to your mobile device in order to verify the request. Here, you can opt to receive a code via text message, or you can install a special authentication app that generates codes offline that are tied to your account. If you're using LastPass to protect your passwords, install the free LastPass Authenticator app to provide these codes — not only

can you then switch on two-factor authentication for services and accounts that support it, but you can switch it on for LastPass, too, making it even more secure.

You can find out if your chosen service supports two-factor authentication by logging into it and exploring the security section of its settings — LastPass users should log into their account at www.lastpass.com and go to 'Account Settings > Multifactor Options', for example. From here, you can pair it with the free LastPass Authenticator app.

Other services make it relatively easy to add multi-factor authentication using LastPass Authenticator (if you can see an explicit reference to it, then choose the Google Authenticator option) by providing you with a QR code to scan into LastPass Authenticator using your mobile's camera, which then automatically pairs your account with the app.

One tip for additional security: what happens if your smartphone or tablet gets stolen? Make sure you tap Settings in LastPass Authenticator and flick the 'Use PIN Code' switch to 'On' to protect it with a six-digit PIN. And remain wary of unexpected requests to use the authenticator app — it may indicate that a hacker has got your password and is hoping you can be tricked into verifying their request for access.

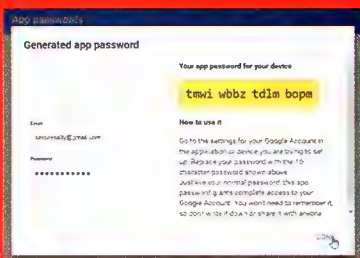
Other alternative password managers include 1Password (1password.com) which works across all your devices including Windows, Mac, Android and iOS. It also offers a web browser plugin.

One-time app passwords

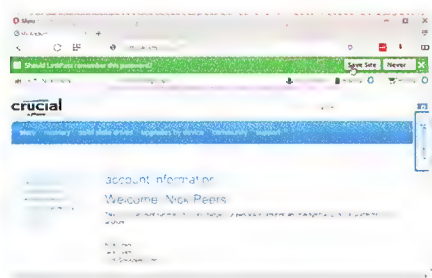
When you enable two-factor authentication, logging into the account on a new device or application should trigger a prompt to confirm your identity, but some older devices and apps — including email apps Thunderbird and Outlook — don't work nicely with it.

The good news is you don't need to source a separate app or compromise your security — most services that offer two-factor authentication offer what's known as one-time passwords. These are passwords you can use in place of a regular password to log into an application or device. If an app refuses to work properly even after entering the correct password, try one of these instead.

If you're a Google user, for example, go to accounts.google.com and sign in. Choose your username, then 'My Account'. Click 'Sign-in & security', scroll down and click 'App passwords' beneath '2-step Verification'. Choose 'Select app' to give your app a name, and a device, then click Generate. Copy and paste the password into the relevant field (tick the option to save it). Now all should be well...



Secure your web logins

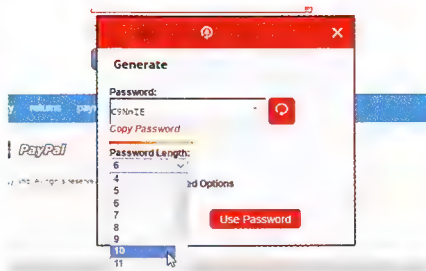


1 REMEMBER LOGINS

Once you've installed LastPass, browse to a website and log in using its username and password in the usual way. After logging in, LastPass will pop up a green bar offering to save the website's credentials for you. Do so, and when you next visit the site, you'll see a LastPass button appear in the login fields — click this to fill your details in quickly.

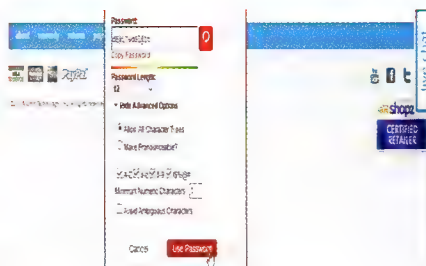
2 UPDATE PASSWORDS

If an existing password you use is a weak one, go to your account's settings and look for an option to update your password. Click the small padlock button next to the password field to generate a new random password. Be sure to set the password length to longer than the default six characters — 10 or more characters is usually best.



3 GO ADVANCED

Click 'Show Advanced Options' and tick the symbols box to increase your password strength further. Once you're happy with it, click 'Use Password'. You'll be prompted that the password has been generated, so click 'Yes, use for this site', then save your changes to update both the account and LastPass. Congratulations! Your password is now more secure. ■



The best Windows security suites

Nathan Taylor uncovers the best security apps for beginners, pros and even users who don't want to pay a cent.

Microsoft is, without a doubt, far better than it once was when it comes to security. Its antivirus tool is no longer a joke, Windows firewall is more than capable and even its recovery and backup systems have improved over time. But it's still not up to the capabilities of a full security suite. The likes of BitDefender, Kaspersky and Symantec have remained a step ahead when it comes to security, and still have better anti-malware, superior parental controls options and a range of system tools that Windows just doesn't have built-in.

So if you're looking to up your security game, a third-party security

suite is still your best bet, and to complement this month's superguide, we're going to look at our current three favourites. We have an editor's pick for techie types, another for beginners and a third for people just looking for a free suite with premium features.

The choices are based partly on test results, but also on additional features and usability. For pros, we chose the suite that gives you the most tools to work with. For beginners, we looked for the suite that does the most while bothering you the least. And for the free suite, we looked for the tool that did the most in a single package without costing a cent.

TEST RESULTS

Each of the suites reviewed here has been comprehensively tested by independent antiviral analysis company AV-Test (www.av-test.org). We've published here the latest results available at the time of writing, from June 2017.

Note that the results are not, in all cases, from the specific products we've reviewed. For example, we may have looked at the full suite where AV-Test may have only tested the standalone anti-virus application, or we may have a product that has been updated since the tests were performed in June. That doesn't change the validity of the results, since the same antivirus engine is in use. So let's break down what the numbers mean:

WINDOWS SECURITY SUITE TEST RESULTS							
VENDOR	TESTED PRODUCT NAME	PROGRAM VERSION	PROTECTION		PERFORMANCE		
			PROTECTION AGAINST 0-DAY MALWARE ATTACKS	DETECTION OF WIDESPREAD AND PREVALENT MALWARE	PERFORMANCE IMPACT WHEN LAUNCHING POPULAR WEBSITES	PERFORMANCE IMPACT ON DOWNLOAD OF FREQUENTLY-USED APPLICATIONS	PERFORMANCE IMPACT ON LAUNCH OF STANDARD SOFTWARE APPLICATIONS
AHNLAB	V3 INTERNET SECURITY	9.0	100%	100%	10%	6%	21%
AVAST	FREE ANTIVIRUS	17.4	100%	99.9%	14%	12%	39%
AVG	INTERNET SECURITY	17.3 & 17.4	100%	99.9%	15%	7%	33%
AVIRA	ANTIVIRUS PRO	15.0	99.0%	100%	9%	6%	15%
BITDEFENDER	INTERNET SECURITY	21.0	100%	100%	19%	2%	11%
BULLGUARD	INTERNET SECURITY	17.1	100%	100%	32%	2%	9%
COMODO	INTERNET SECURITY PREMIUM	10.0	100%	99.9%	29%	2%	12%
ESET	INTERNET SECURITY	10.1	99.0%	99.9%	14%	11%	63%
F-SECURE	SAFE	14	100%	99.9%	27%	3%	9%
G DATA	INTERNET SECURITY	25.3	99.0%	100%	26%	1%	41%
K7 COMPUTING	TOTALSECURITY	15.1	99.0%	99.8%	6%	1%	4%
KASPERSKY LAB	INTERNET SECURITY	17.0	100%	100%	5%	0%	7%
MCAFFEE	INTERNET SECURITY	19.0	99.0%	100%	7%	0%	11%
MICROSOFT	WINDOWS DEFENDER ANTIVIRUS	4.11	99.0%	99.7%	8%	0%	19%
MICROWORLD	ESCAN INTERNET SECURITY SUITE	14.0	100%	100%	9%	1%	4%
SYMANTEC	NORTON SECURITY	22.9	100%	100%	6%	4%	7%
THREATTRACK	VIPRE INTERNET SECURITY PRO	9.3	97.9%	100%	10%	2%	25%
TREND MICRO	INTERNET SECURITY	11.1	100%	100%	13%	0%	6%

- Protection against 0-day malware attacks is a measure of the suite's ability to detect new viruses based on their behaviour. It's perhaps the most important number here.
- Detection of widespread and prevalent malware shows the detection percentage of known viruses released in the four weeks before the test.
- The performance impact ratings give percentages by which the suite slows down a mid-range PC when performing common tasks.
- False warnings is the number of instances where the suite flagged legitimate software and websites as a threat and either blocked it or produced a warning popup.

For convenience, AV-Test also provides three overall scores, rating each suite's protection, performance impact and usability out of 6, to give a total score out of 18. (Usability, in this instance, is not a reference to ease-of-use, but is based on the number of times the program produced false popups and blocked legitimate software). We should note that AV-Tests aggregate scores are based on combined May-Jun performance, while we've only printed June results for space reasons.

"The likes of BitDefender, Kaspersky and Symantec have remained a step ahead when it comes to security, and still have better anti-malware, superior parental controls options and a range of system tools that Windows just doesn't have built-in."

Paid suites vs free tools

In 2012, it would seem that you can get everything you need using completely free software.

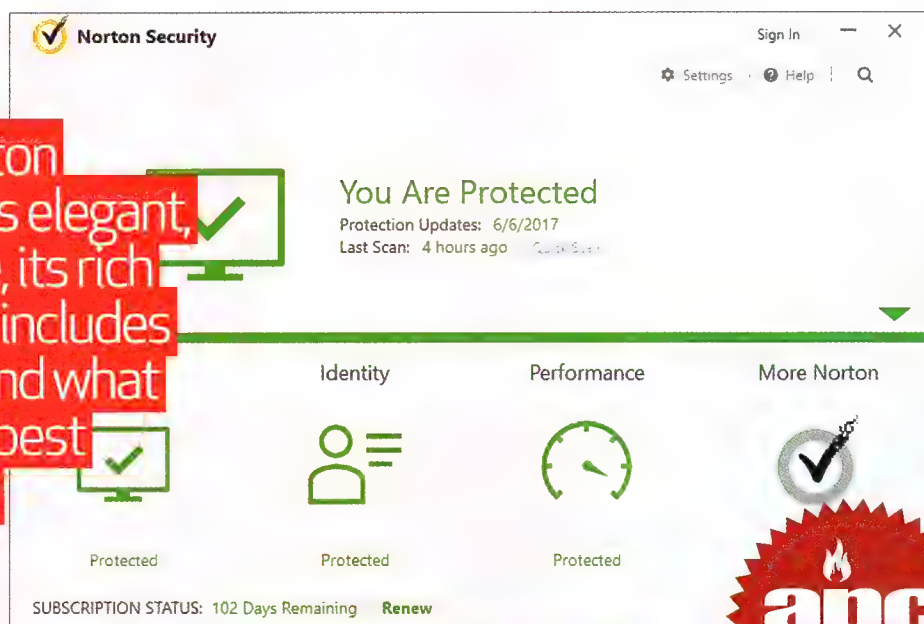
There are entire suites now that are free to download, and tons of tools that you could combine together to make an effective suite. All this is true, if you have the knowledge and time investment to do so.

You should remember, however, that when you pay for a commercial suite, it's not only the software that you're paying for — it's the support. Most suites come with 24/7 helplines, live chat and remote control support. You — the tech-savvy, APC-reading super-herd — may not need support services, but it's probable that your family members might. That's why, even in a world where free suites are a thing, we often still recommend that most people get a commercial suite. Having an expert (not the designated family go-to guy) to call when things go wrong is absolutely worth \$100-odd per year.

USABILITY

PERFORMANCE IMPACT ON INSTALLATION OF FREQUENTLY- USED APPLICATIONS	PERFORMANCE IMPACT ON COPYING OF FILES, LOCALLY AND IN A NETWORK	FALSE WARNINGS OR BLOCKAGES WHEN VISITING WEBSITES	FALSE WARNINGS ON INSTALLING NEW SOFTWARE	FALSE BLOCK- AGES OF CERTAIN ACTIONS CARRIED OUT WHILST INSTALLING AND USING LEGITI- MATE SOFTWARE	PROTECTION SCORE	PERFORMANCE SCORE	USABILITY SCORE	TOTAL SCORE
25%	2%	0	0	0	6.0	5.5	6.0	17.5
14%	3%	0	1	0	6.0	5.0	6.0	17.0
17%	6%	0	1	0	6.0	5.0	6.0	17.0
13%	4%	0	1	0	6.0	6.0	6.0	18.0
11%	4%	0	1	0	6.0	6.0	5.5	17.5
36%	13%	0	1	1	6.0	5.5	5.5	17.0
43%	76%	0	6	4	6.0	2.0	4.5	12.5
29%	25%	0	1	0	5.5	4.5	6.0	16.0
29%	2%	0	3	0	6.0	5.0	5.5	16.5
33%	15%	0	2	0	5.5	4.5	5.5	15.5
17%	26%	0	2	0	5.5	6.0	5.5	17.0
14%	2%	0	0	0	6.0	6.0	6.0	18.0
18%	7%	0	0	0	5.5	6.0	6.0	17.5
56%	1%	0	7	0	5.5	5.0	4.5	15.0
21%	2%	0	1	1	6.0	6.0	5.5	17.5
24%	12%	0	0	1	6.0	6.0	6.0	18.0
25%	22%	0	1	0	5.0	4.5	5.5	15.0
14%	19%	0	0	0	6.0	6.0	6.0	18.0

"What puts Norton over the top is its elegant, simple interface, its rich feature set that includes online backup, and what is the industry's best parental control solution."



BEST WINDOWS SECURITY SUITE FOR BEGINNERS

\$80 FOR 3 DEVICES FOR 1 YEAR | AU.NORTON.COM

Norton Security Premium for 3 Devices

The best solution for families.

Norton is one of the slickest, least intrusive and most accessible suites on the market now. It does a lot while asking very little.

That's true of a number of suites now, but what puts Norton over the top is its elegant, simple interface, its rich feature set that includes online backup, and what is the industry's best parental control solution.

The subscription for Security Premium includes a full sub to Norton Family Premium, a cloud-based parental control system with outstanding tools for managing and monitoring kids' online activities. It generates reports, shows snippets of videos they're watching, lets you limit their access times or sites they can visit, and much more. All the rules are managed through a portal site, so there's no need to set up anything on their PCs.

A lot of beginners don't do proper backups or subscribe to backup services, but this makes it easy to have automated backup to a secure cloud server, which is a key tool for mitigating ransomware attacks. Its biggest problem is that the 25GB limit is far too stingy.

There are a lot of other things going on the background as well. It managed a perfect score in AV-Test's benchmarks and had very little impact on performance. There's a ton of hidden features: banking protection, website filtering, identity protection, password management, system tuning and cleaning, and more. It does all this automatically, too. It also has a neat cloud-based management system that lets you remotely monitor and manage multiple PCs attached to the licence.

Like many suites now, the Norton Security licence also applies to mobile devices

and Macs as well. Its mobile parental controls are particularly good on Android, where all the rules that you configure can still be applied. Passwords stored on desktops will be taken to your mobile as well. Unfortunately, these aren't available on iOS.

We love the elegance of the solution overall. Setting it up requires very little expenditure of effort, and even the online backup system intelligently figures out what to back up for you and requires virtually no setup. There are useful cloud management tools for multiple devices, and great mobile support as well.

Verdict

Easy to use, accessible for everyone and possessed of the best parental controls around.



Runner up: Trend Micro Maximum Security

\$80 FOR 6 DEVICES FOR 1 YEAR
WWW.TRENDMICRO.COM.AU

If it weren't for Norton's parental controls, Trend Micro might have taken the prize. We've had better experiences with it when it comes to actual malware cleanup (Norton also often gives a 'Get Help' response rather than cleaning the infection), and like Norton, it does a lot in the background without making a big deal about it. There's password management, link protection, cloud drive scanning, one-click system optimisation, folder locking, social media privacy checkups, a secure browser and a whole lot more. It also covers more devices for your \$80, and that includes mobiles.



"The parental controls are also excellent, second only to those offered by Symantec, with a cloud-based management and policy centre. You can also use the portal site to monitor devices attached to the license and even remotely trigger scans."

BEST WINDOWS SECURITY SUITE FOR PROS

\$72 FOR 5 DEVICES FOR 1 YEAR | WWW.BITDEFENDER.COM.AU

BitDefender Total Security 2018

Still the best.

For many years, BitDefender has been our pick for advanced users, and even a good pick for beginners as well, thanks to its autopilot mode.

The set of features available is equalled by few suites. It has a firewall, anti-malware and anti-spam, but also secure browsing, file locking to prevent ransomware encryption, anti-theft tools, game modes, parental advisors, social network protection, password manager, file shredder, security auditor, system cleanup and more. In this latest version, it's added webcam access monitoring (which works much better than Windows' permissions), as well as an improved anti-ransomware file locking tool. File access to selected folders can now be permission-based.

The parental controls are also excellent, second only to those offered by

Symantec, with a cloud-based management and policy centre. You can also use the site to monitor devices on the licence and remotely trigger scans.

It achieved perfect scores in AV-Test's antivirus benchmarks. We've had excellent results with its removal engine as well — it does a good job of cleaning infections after detection, and includes a pre-boot mode for ripping problematic elements out. It also has one of the best recovery drive/disc creators going, with a good set of tools available for repairing a system that's so messed up you can't even boot into it.

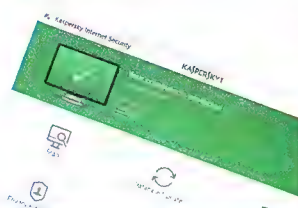
All the tools, options and reports are highly configurable, and you can really drill down into a lot of features if you've a mind. You can set multiple location profiles and adjust sensitivity sliders if you want to increase the aggressiveness of its

heuristic scans. If you don't want to do that, you can always switch BitDefender into autopilot mode, which lets it make most of the decisions for you. We've never had any real problems with autopilot, and it's smart enough to make firewall and cleanup decisions without your input.

This suite is everything a security suite should be: full of features but easy to manage, highly configurable yet also capable of auto-configurations, and designed to not just detect threats but also get them out of your system. It's still the best suite around, and our top pick amongst all suites.

Verdict

Excellence across the board and at damn good price.



Runner up: Kaspersky Total Security

A very close second

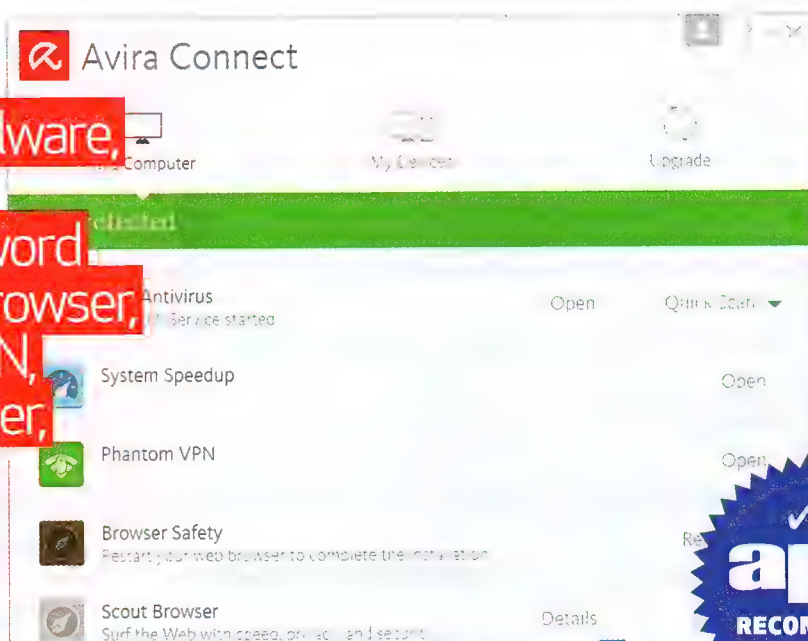
\$120 FOR 3 DEVICES FOR 1 YEAR

WWW.KASPERSKY.COM.AU

Although BitDefender is still our top suite pick, it was a very near-run thing. Kaspersky continues to improve, and Total Security has a feature set that very closely rivals that of BitDefender. All the tools you could really want are built into the suite — including backup, file encryption, webcam monitoring, cloud-based parental controls and a password manager. It even includes a volume-limited VPN for secure connections when you take your laptop onto public Wi-Fi hotspots.

Really, the biggest thing stopping it from overtaking BitDefender is the price. In terms of features and capabilities, it's on par

"In a free package, it provides anti-malware, system tune-up, cloud-based password manager, secure browser, volume-limited VPN, web and search filter, and a software update checker."



BEST FREE WINDOWS SECURITY SUITE

FREE | WWW.AVIRA.COM

Avira Free Security Suite

An awful lot of tools for nothing.

It used to be the case that, if you wanted a free suite, you had to DIY it together from various free apps. Not anymore.

Of the suites available, Avira is currently our top pick. In a free package, it provides anti-malware, system tune-up, cloud-based password manager, secure browsing, volume-limited VPN (with 1GB/month), web and search filter, and a software update checker. You can manage multiple devices from a single desktop as well. It's a pretty comprehensive package.

It will not, however, rival a commercial suite. It's good, but it's not up to par with the likes of Symantec, BitDefender and Kaspersky. It has no firewall – it uses Windows firewall – and a number of the deeper features you might find in those suites are missing. There's no ransomware locker, nor webcam monitor

or application sandbox. The tune-up tools are restricted in the free version, and there are no backup tools or parental controls.

What is there, though, is pretty good. Avira's anti-malware engine received a perfect overall score in AV-Test's benchmarks, being both effective and light on system resources. It cleans a system well, and the extra tools are useful. The VPN is particularly convenient, and the Scout secure browser is excellent.

There is some annoying upsell, though. You're reminded that the VPN is limited to only 1GB per month, while the paid version offers unlimited access. The software update checker and system optimisation tools are also a little crippled, with the full set of features only available in the paid version.

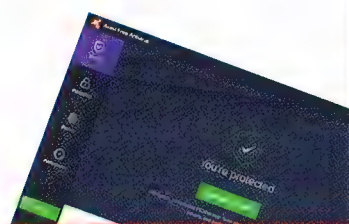
The suite isn't difficult to use, though it is a little scattershot and not terribly

well integrated. It's chattier than something like Symantec or BitDefender in autopilot mode, but straightforward and comprehensible for both beginners and advanced users. Avira Connect lets you manage multiple devices from a single PC. It's more than just monitoring alerts: you can see the status of components, as well as trigger remote scans.

While not as good as a \$100-per-year commercial suite, for free, it offers an awful lot – including some things that commercial suites don't. If you're not going to pay for a suite, this is definitely the next best thing.

Verdict

A suite that would have cost \$100 several years ago. Not bad, for something that's free.



Runner up: Avast Free Antivirus

The best free antivirus on sale

\$80 FOR 6 DEVICES FOR 1 YEAR
WWW.TRENDMICRO.COM.AU

Although it's not marketed as a 'suite', Avast Free Antivirus is more than just an anti-malware application. It includes a pretty good password manager, secure browser and a modest set of utilities for monitoring Wi-Fi security and identity theft. It's very easy to use, and has excellent antivirus detection rates from AV-Test's results.

It's not anywhere near the kind of full suite that you'll get in a commercial product, but for an advanced user who is careful and doesn't need a lot of the hand-holding that a full suite provides it can be more than enough.

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- ❖ 5 Giga Ethernet ports included, port #5 can be configured as Ethernet WAN
- ❖ QoS and firewall supported
- ❖ 2 FXS ports for SIP VoIP call (option)
- ❖ VPN tunnels for IPSec, OpenVPN, GRE, L2TP, and PPTP connections (option)



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Security on Android

Lindsay Handmer reveals everything you need to know about securing your Android phone or tablet.

We are increasingly storing and accessing our entire digital lives through a smartphone, and security is a growing issue. It's not just personal information, but breaches can leave your bank accounts, credit card or services open to attack. Fortunately, security on Android is generally excellent, and there are plenty of third-party options available for extra peace of mind.

SECURITY UPDATES

Devices in active use, yet which are not kept updated, are one of the biggest Android security problems. In 2016, half the Android devices out there did not receive any updates, leaving them exposed to new vulnerabilities. It's not just users falling behind on updates — many manufacturers don't support older models for very long. Keep your Android device updated, or if updates are not available, consider upgrading to a newer model.

MALICIOUS APPS

The second largest threat to Android security are malicious apps, which can do anything from harvest personal information, to pop up annoying ads. The vast majority of problem apps come from sources outside of the Google Play Store. In 2016, only 0.05% of Google Play store apps were compromised, so the vast majority of issues come from using third-party app stores. App stores such as Amazon are generally safe, but the numerous third-party stores (even the largest, such as [getjar.com](#)) are best avoided outright.

PHISHING ATTEMPTS

Links in SMS, email, apps or websites can be used to trick users into visiting a malicious page, or downloading an infected app or file. If someone else's device is already infected, the messages can look like they are coming from a legitimate source. Getting infected yourself can result in anything from secret premium calls or text to rack up bills, to stealing personal information, or just popping up ads. The best way to avoid infection is to not visit any links that

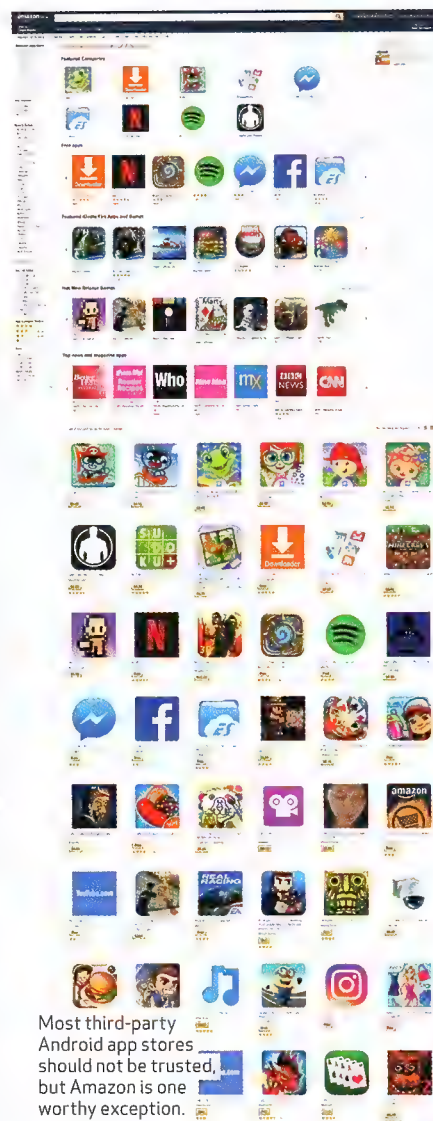
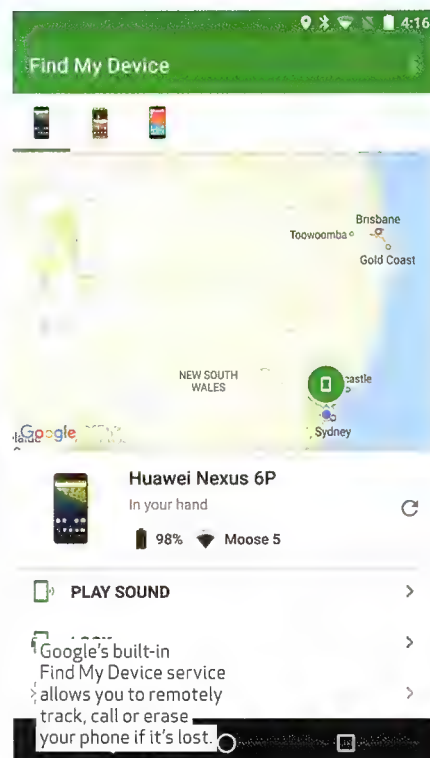
you don't trust, especially from unknown sources, such as via SMS. Google does have inbuilt safe browsing in apps such as Chrome and Gmail, which can help provide protection, but are not foolproof.

WI-FI WOES

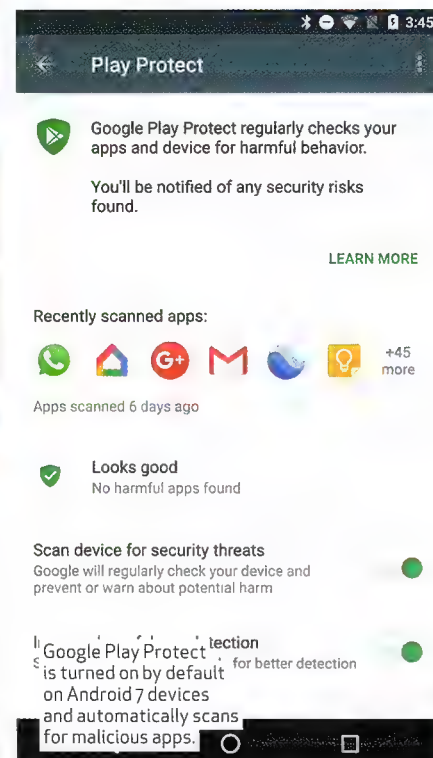
Accessing an unsecured Wi-Fi network is an easy way to have your data snooped on or harvested. Even supposedly safe, secure Wi-Fi networks can be compromised or fake. The best bet is to avoid Wi-Fi unless you know the source is safe (such as at home or a friend's house), or use a VPN. For Android, Hola VPN ([hola.org](#)) is free and ideal for occasional use. Otherwise Windscribe ([windscribe.com](#)) costs ~\$5 per month, but can be used on unlimited devices (including a computer) with no bandwidth restrictions.

ACCOUNT AND PHYSICAL SECURITY

While malware is a big concern, the security of your Android device also depends on restricting outside access. Your smartphone should use a PIN



Most third-party Android app stores should not be trusted, but Amazon is one worthy exception.



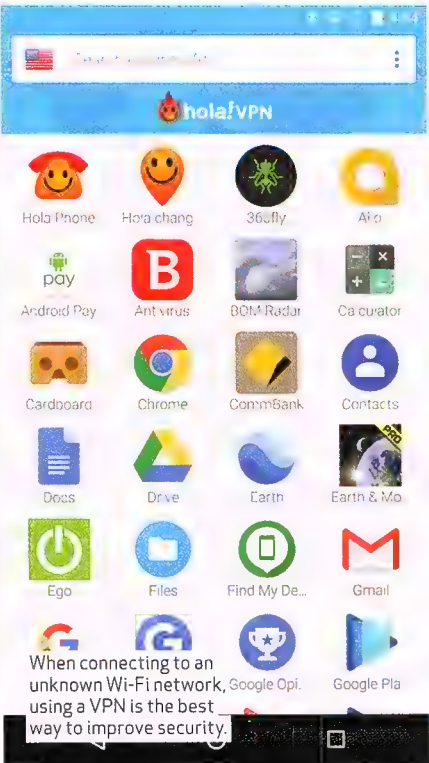
or fingerprint security, and make sure notifications are not set to show up on your lock screen. Make sure any passwords (or PIN) used is not easy to guess, or reused across multiple accounts. Turn on two-factor authentication for your Google account, as well as for services such as internet banking. It's possible to see if a password has been compromised through a third-party hack on haveibeenpwned.com – change the password immediately and discontinue its use if so.

BUILT-IN ANDROID SECURITY

Fresh out of the box, your device is already pretty secure. Google Play Protect is enabled by default on Android 7 phones, which checks 1 billion devices and 8 billion apps every day, and removes anything malicious. Apps are sandboxed, devices are encrypted, and you can locate, lock, wipe or call your phone by typing "find my phone" into Google when signed into your account. Older devices are also protected by Google Play scanning, but not to the same level.

SECURITY APPS

For those who want extra protection, there are loads of free and paid security apps. We have included a review of two of our favourite here, but there are plenty of other options with features that suit different users. A great way to compare how effective they are is with AV-Test's Android security testing (www.av-test.org), which compares features and rates each app.



FREE | WWW.SOPHOS.COM
100% MALWARE DETECTION, AUTOMATIC PROTECTION, SPAM CALL BLOCKING

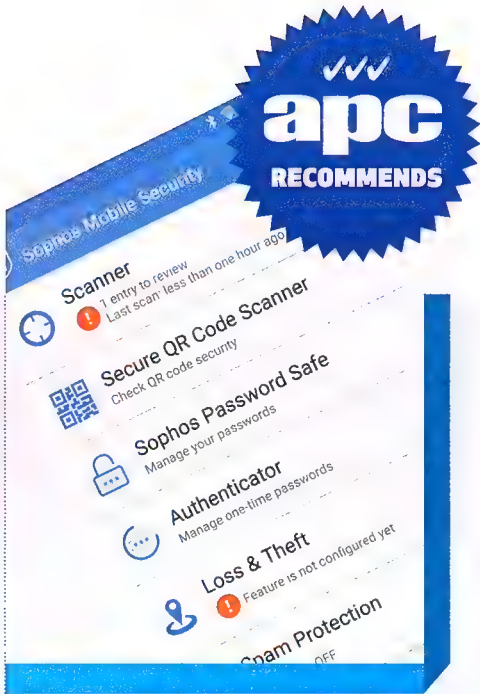
Sophos Mobile Security
Best free Android security suite.

By far our favourite option, Sophos Mobile Security is free for personal use, with no ads or reduced functionality. Even better, in the 14 tests since 2014, Sophos has picked up 100% of malware in the AV-Test security app comparisons. Sophos Mobile Security scans apps on install for any malicious content, and can perform on-demand or scheduled scans of a device's contents. It also has a comprehensive theft protection system, which includes remote locks, wipes, location tracking and SIM change detection. The app also protects from other threats, including web filtering and URL checks, spam call and SMS blocking and insecure Wi-Fi monitoring. It includes a built-in Authenticator service and password manager, can protect apps with a password, PIN or fingerprint, and lists apps that could access personal data.

It's quite easy to get up and running for beginners, but also offers loads of advanced options. Effect on battery life and performance is minimal, as it can be set to only scan when charging.

Verdict

A wide range of easy to use features for a price that can't be beat.



\$20 PER YEAR | WWW.BITDEFENDER.COM.AU
100% MALWARE DETECTION, ACCOUNT BREACH CHECKING, SMARTWATCH SECURITY

BitDefender Mobile Security & Antivirus
Best pro solution.

Thanks to a 14-day free trial, BitDefender Mobile Security & Antivirus is easy to try, after which, it costs \$20 a year. The app provides excellent security scanning, picking up 100% of malware in AV-Test's latest comparison. Where it stands out is a few key features not found on most free competitors, including checking your email for account breaches. The app also extends security to a smartwatch, and can be used to sound an alarm if you're separated from your phone. The web security is a cut above most, especially with Chrome, and includes an app locker and privacy advisor. The anti-theft is also above average, with premium features such as mugshots pics, and the ability to listen in on the phone, as well as the usual tracking and wiping options.

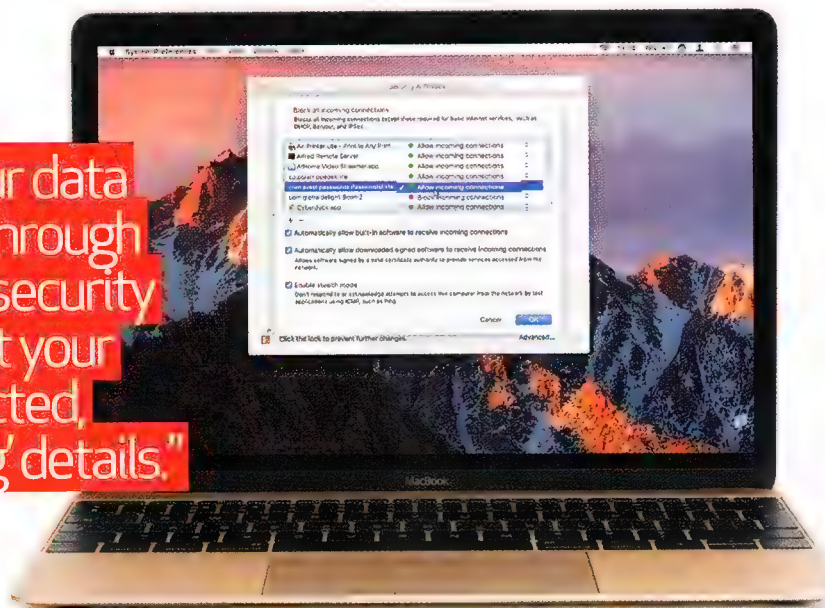
The app is intuitive to use, and doesn't have a noticeable impact on battery life, or phone performance. The competition from free alternatives is stiff, but this is a great paid option, especially for those with Android wearables. ■

Verdict

An affordable price gives excellent protection and premium features.



"To make sure your data stays safe, work through our fundamental security tips to ensure that your Mac is well protected, that it isn't 'leaking' details."



Security on Mac

Roland Waddilove has some tips on how to stay safe when using your Mac at home or on public Wi-Fi hotspots.

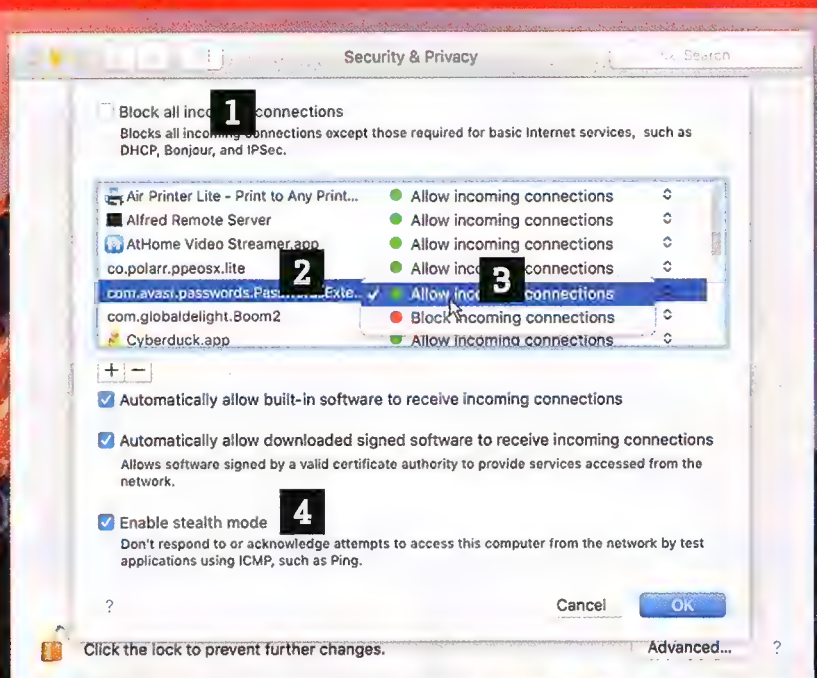
Security is a constant worry, so your choice of a Mac instead of some other kinds of computer is certainly a good decision. However, while the Mac has enjoyed a reputation for security in the past, that doesn't mean you can ignore the cunning ways you can be tricked into

revealing information. For example, email attachments, phishing attempts and sharing too much at public Wi-Fi hotspots are just some of the problems that can affect your security.

To make sure your data stays safe, work through our fundamental

security tips detailed in the following pages to ensure that your Mac is well protected, that it isn't 'leaking' details (especially if you use public Wi-Fi hotspots), and that you understand and avoid common traps.

Firewall options



1 ULTIMATE SECURITY

Check this box to turn up firewall security to the max. The Mac blocks all connection attempts over the network, apart from essential ones.

2 ALLOWED APPS

This is a list of all the apps that are allowed to communicate over your network connection. Search online for any you don't recognise to check it isn't malware.

3 BLOCK ACCESS

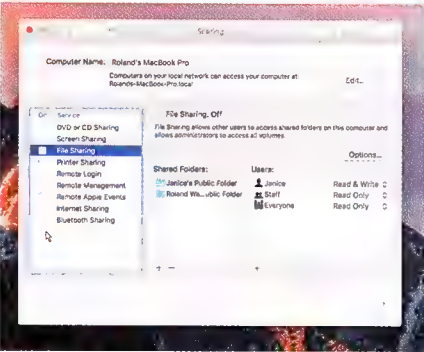
If you find an app in the list that you don't recognise and which looks suspicious, click here and set its network access rights to 'Block incoming connections'.

4 HIDE YOUR MAC

There are easy ways for nefarious people to detect your Mac over a network. Enabling stealth mode stops this, and is useful when using a public Wi-Fi hotspot.

How to

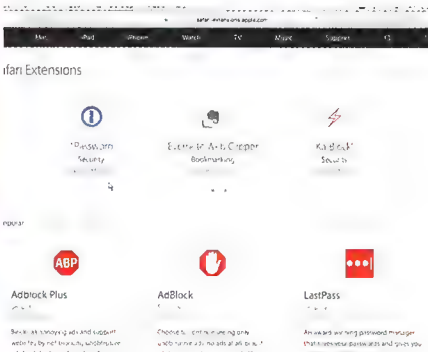
Shore up your Mac's security



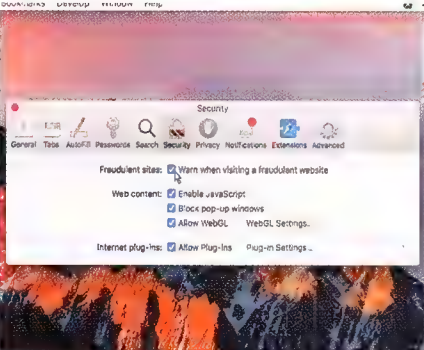
1 DISABLE FILE SHARING
It can be useful to be able to share files, printers, screens and other features while at home, but you should disable them in System Preferences' Sharing pane when using your MacBook on other networks.



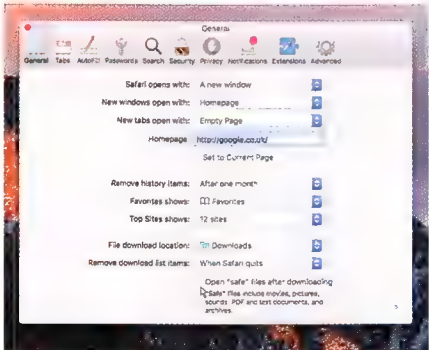
2 ENCRYPT THE DISK
Encrypting your Mac's storage prevents anyone else from accessing its contents. Go to 'System Preferences > Security & Privacy > FileVault' and click 'Turn on FileVault' — your Mac is then encrypted even as you use it.



3 SAFARI EXTENSIONS
There are great extensions for Safari, but some risky places on the internet to download them from. Stick with Apple's curated collection for safety: in Apple's web browser, choose 'Safari > Safari Extensions'.



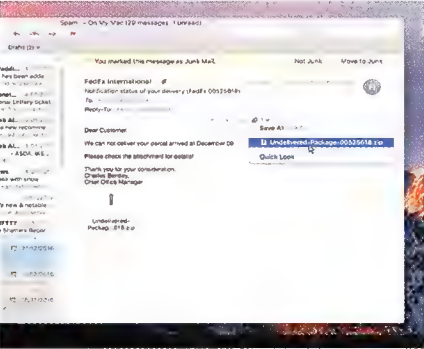
4 FRAUD WARNINGS
Safari is able to warn you about unsafe websites before you even go to them. Again with Safari in the foreground, go to 'Safari > Preferences > Security' and check the 'Warn when visiting a fraudulent website' setting.



5 AVOID 'SAFE' FILES
Safari can automatically open supposedly safe files after downloading them, which is convenient for you but also for malware. In Safari's General preferences, clear the checkbox next to the corresponding option here.



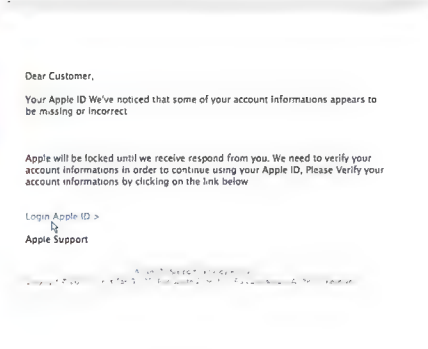
6 AVOID JAVA
Java has been reported to have been used by malware authors for years. Only install it if absolutely required. See apple.co/2hMBdgF regarding the browser plugin, and bit.ly/2rqgP99 for uninstallation steps.



7 EMAIL ATTACHMENTS
Malware can be distributed through email attachments — and this isn't just used to target Windows PCs. Do not open or download files from emails unless you know they are from a trusted source and safe.



8 WHERE TO GET APPS
The Mac App Store is the safest place to get Mac software, as Apple vets what's featured. If you must get an app from elsewhere, use its developer's published checksum to verify the file is unaltered — see bit.ly/2rVu1q3.



9 AVOID LINKS IN EMAIL
Phishing tries to trick you into revealing details of your Apple ID, bank, PayPal and other accounts. Treat emails asking for login details with suspicion and don't click links. If in doubt, go to a site's address manually. ■

Learn how to lock down Facebook

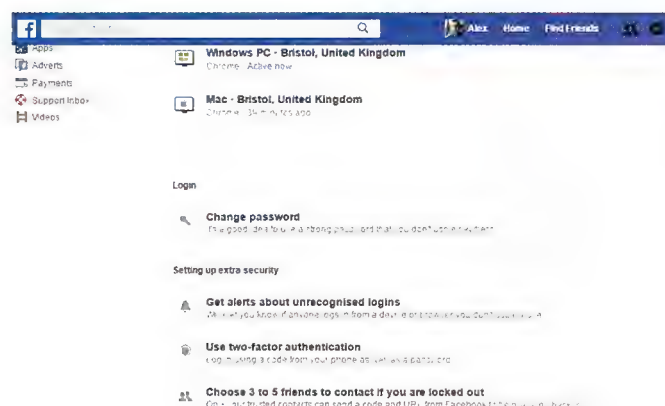
The social media giant is great for sharing, but it's easy to overshare — but you can control who sees what with a little help from this guide by Alex Cox.

There's a good reason Facebook is the most popular social network in the Western world. It's easy to join, easy to connect with your friends and incredibly convenient. If you want to share something, it's only a couple of clicks away. But is that really such a good thing? Do you want every one of your friends to see every little thing you post? Should anybody that stumbles on your profile be allowed to poke through your family pictures or find out your personal information? Absolutely not.

Facebook doesn't exactly hide its privacy features, but it doesn't push them either. It's up to you to decide how secure you want your account and posts to be. We'll walk you through the steps and safeguards; use your own judgement over how much you want to put in place, to ensure the people that matter can still see your posts and profile.

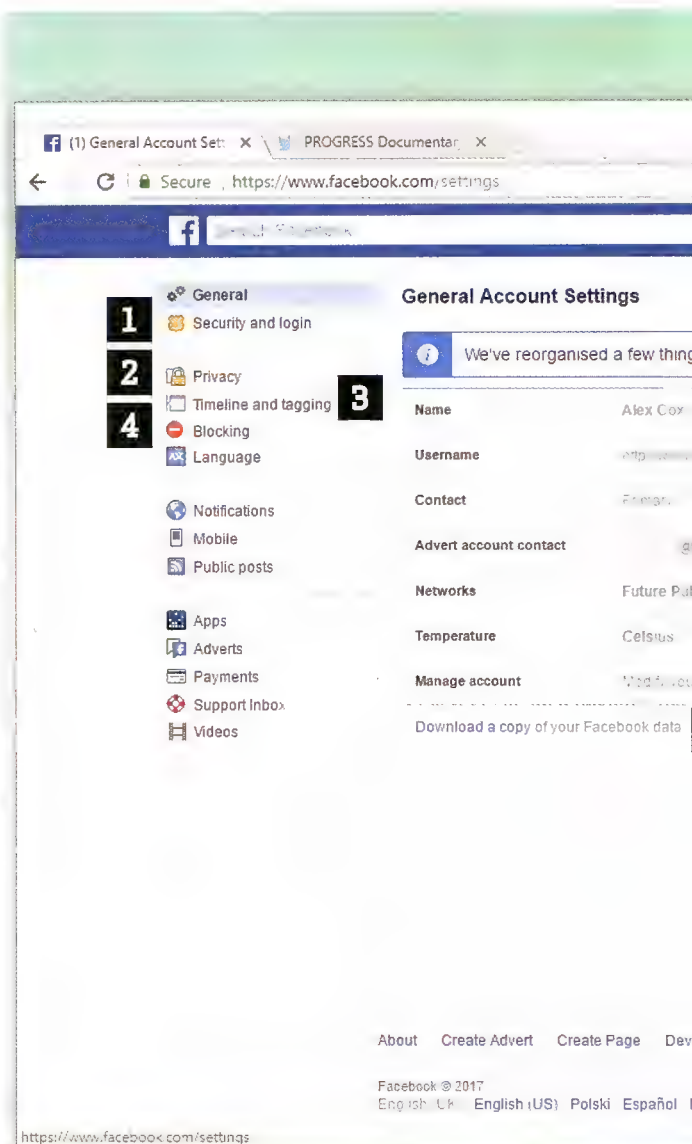
Step-by-step

Make Facebook more secure.



1 LOGIN PROTECTION

First, let's make sure nobody can get into your Facebook account and post anything they shouldn't and, if they do, that you'll know about it. Head to www.facebook.com as usual and, on the right side of the blue header bar, click the downward pointing arrow and head to Settings. In the left column, click 'Security and login', then scroll down to the 'Setting up extra security' section.



Setting up extra security

Get alerts about unrecognised logins

We'll let you know if anyone logs in from a device or browser you don't usually use

When a device or browser logs in to your account from an unrecognised location, you'll receive a notification.

Notifications

- Get notifications
- Don't get notifications

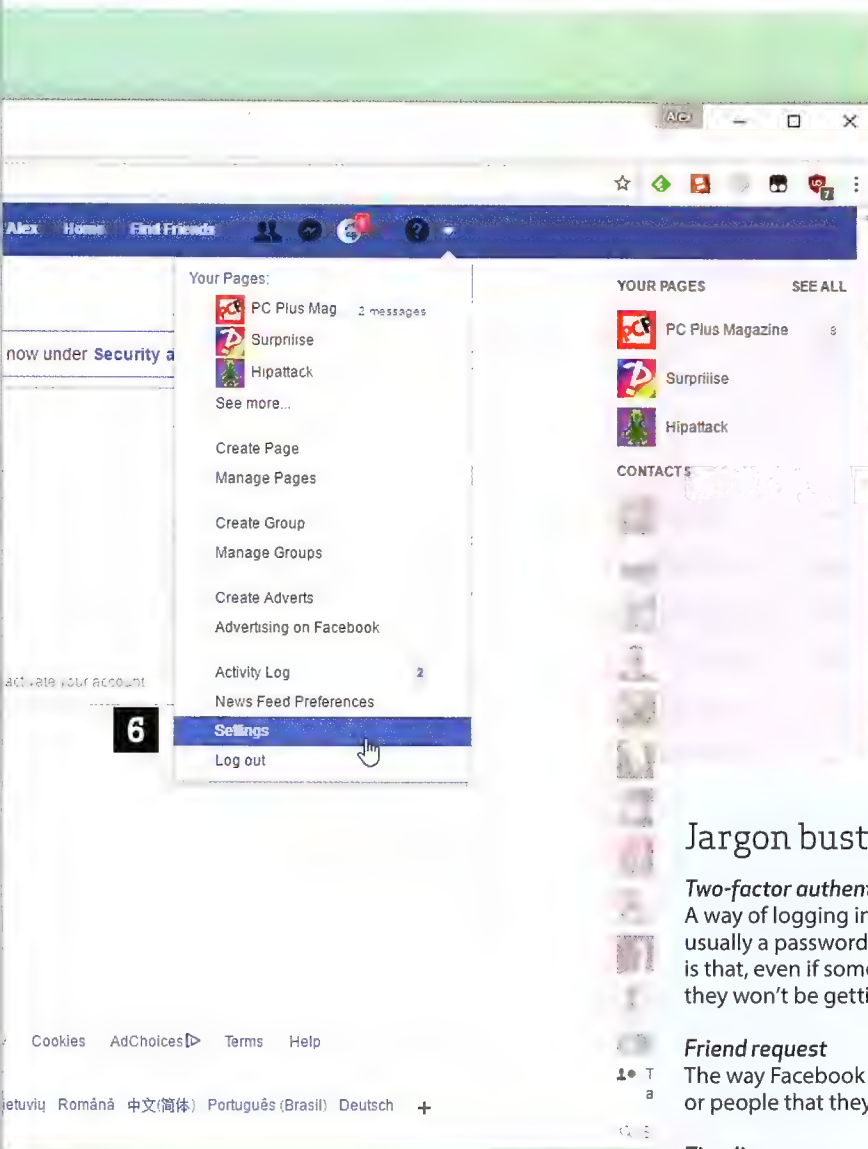
Email address

- Email login alerts to ataric0n@gmail.com
- Don't get email alerts

Add another email address or mobile number

2 NOTIFY ME

Click Edit next to 'Get alerts about unrecognised logins', and select the appropriate options to receive a Facebook notification when a new machine logs in, or an email sent to any addresses you've confirmed with Facebook in the past, then save changes. There's a link here to add a new address, which will take you to more settings; click 'Security and login' to get back.



1 ACCOUNT PROTECTION

Use the 'Security and login' section to lock your account and so prevent unwanted intrusion.

2 GET UNFRIENDLY

Unsolicited requests from people you don't really know can be unsettling — block them in the Privacy section.

3 REVIEW YOUR TAGS

See what friends are posting about you by activating 'tag reviewing' under the 'Timeline and tagging' option.

4 BLOCK AND MUTE

Remove every nuisance, from troublesome friends to annoying app requests, in the Blocking section.

5 BACKUP NOW

Even if you're not concerned about security, you may want to keep a copy of your account data in case of disaster.

6 START SETTING UP

To find all of these settings, use the Settings option in Facebook's less-than-obvious drop-down menu.

Jargon buster!

Two-factor authentication

A way of logging into a service which requires two parts — usually a password, plus another single use code. The idea is that, even if someone does find out your password, they won't be getting in without a fresh code.

Friend request

The way Facebook users connect with people they know — or people that they want to know.

Timeline

All your Facebook posts are arranged in chronological order — at least in theory. However, that is not always the case.

Setting up extra security

- Get alerts about unrecognised logins**
We'll let you know if anyone logs in from a device or browser you don't usually use
- Use two-factor authentication**
Log in using a code from your phone as well as a password
- Choose 3 to 5 friends to contact if you are locked out**
On • Your trusted contacts can send a code and URL from Facebook to help you log back in

Your trusted contacts are friends who will phone and/or message you if you ever have trouble accessing your account.

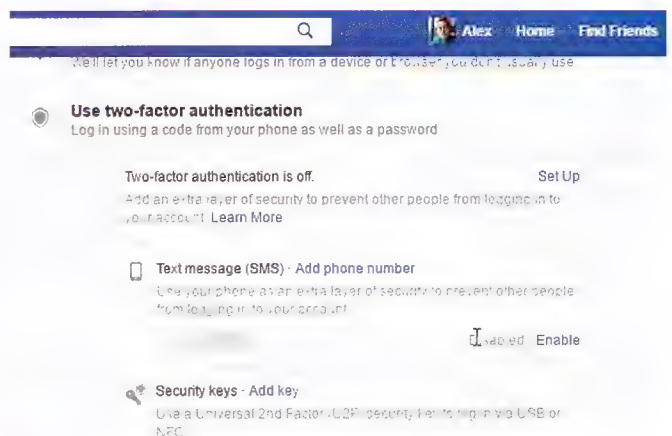
Your trusted contacts:

Edit Remove All



3 FRIENDLY HELP

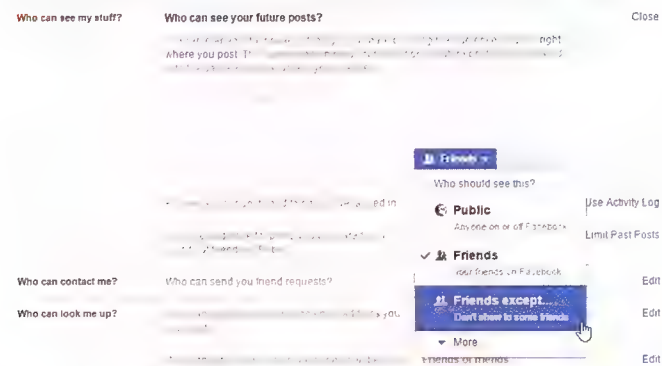
Select the 'Choose 3 to 5 friends...' option, then click 'Choose friends'. Facebook gives you the option of choosing real-life buddies who can help you get back into your account should it be compromised. Click 'Choose trusted contacts', type their names — Facebook will find them from your friends list — and click Confirm. That's it for you; they'll be informed of what they need to do next.



4 THE SECURITY FACTOR

Two-factor authentication, the middle option, means you'll need two things to log in — your usual password, and a security code. This could be generated by your Facebook mobile app, sent to your phone, or pulled from a cache of spare codes that you'll keep secret. Run through the options to set this up — it's easy as long as you have a mobile number associated with your account.

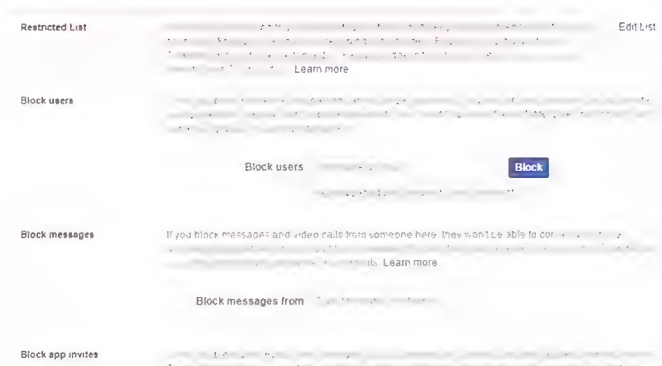
Privacy Settings and Tools



5 DEFINING DEFAULTS

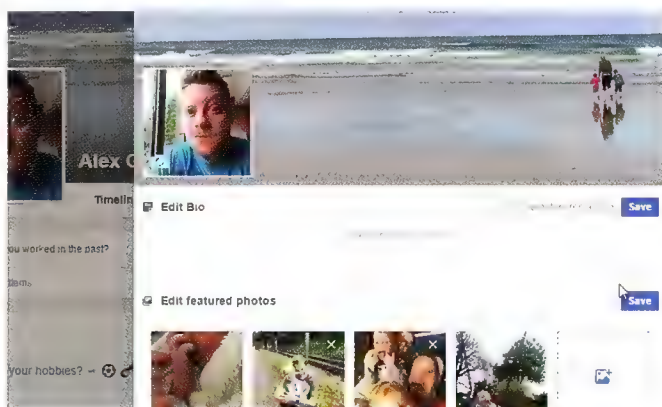
Select Privacy in the left column. Here, you can define the default privacy settings for your future posts — we'd recommend Friends, although it's possible to exclude some on your friends list by choosing 'Friends except...' or set all your posts to private — this couldn't be more secure, although you'll need to manually set the privacy of each post as you make it — see Step 10 below.

Manage blocking



7 BLOCK AND BANISH

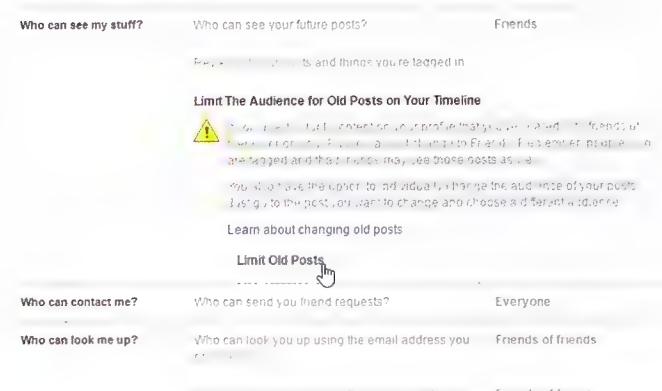
You can do more than deflect friend requests — head to the Blocking section in the left column of settings and you can deny app requests, block specific users from seeing anything you post, stop people contacting you via Facebook Messenger, and more. You can also block and mute users on your timeline by clicking the downward arrow on their posts and reviewing your options.



9 CLEVER MOVES

Your next step isn't one that Facebook can help you with directly, it's more common sense. Click your profile picture on the blue bar to head to your profile page, then click 'Edit profile'. Remove any information that isn't absolutely critical to someone finding you — be as cagey as you can. To hide old posts, click the top right arrow on each one, select Edit and change the status.

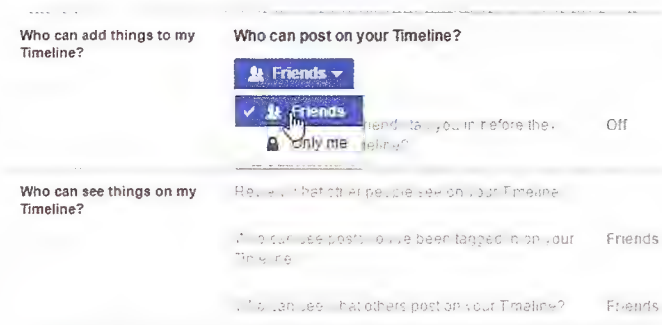
Privacy Settings and Tools



6 GET RETROACTIVE

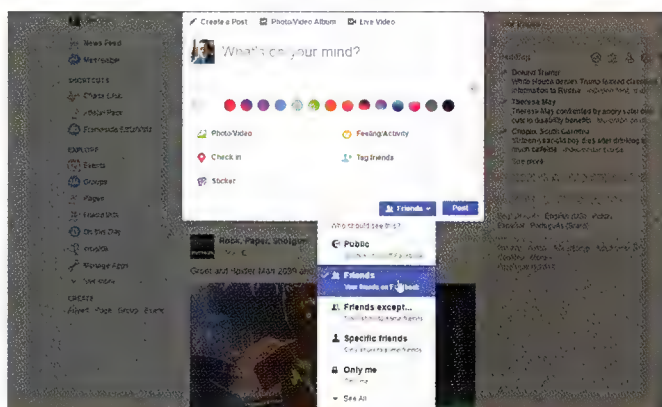
If you've previously been posting things publicly, you may be worried that you'll now have to plough through all your old posts to hide them from prying eyes. Not so — use the 'Limit past posts' option to automatically set your archived posts to friends-only. You can also use the options below to restrict who's allowed to look you up or canvass you with a friend request.

Timeline and Tagging Settings



8 PROFILE PRIVACY

Now use the 'Timeline and tagging' section to choose who's allowed to see your profile page. This is perhaps the most critical part of everything we're doing here — your profile page could well be linking to personally identifying information, so you'll want to ensure non-friends can see as little as possible. If embarrassing relatives keep posting to your timeline, you can nix it here, too.



10 POSTING CLEVER

Now click the Facebook logo to head back to your timeline. In the box at the top, begin creating a new post. You'll see, at the bottom of the post composition box, a drop-down box marked Friends. This is the post's privacy; you can quickly set a post to private, or share it with specific people, by clicking this box. Bear in mind when you post from now on. ■

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and
ready to go



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Kingsman: The Golden Circle
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vision at Heart

www.aocgaming.com.au

Give yourself a Google privacy check

Nathan Taylor shows you how to stop Google from tracking your online activity.

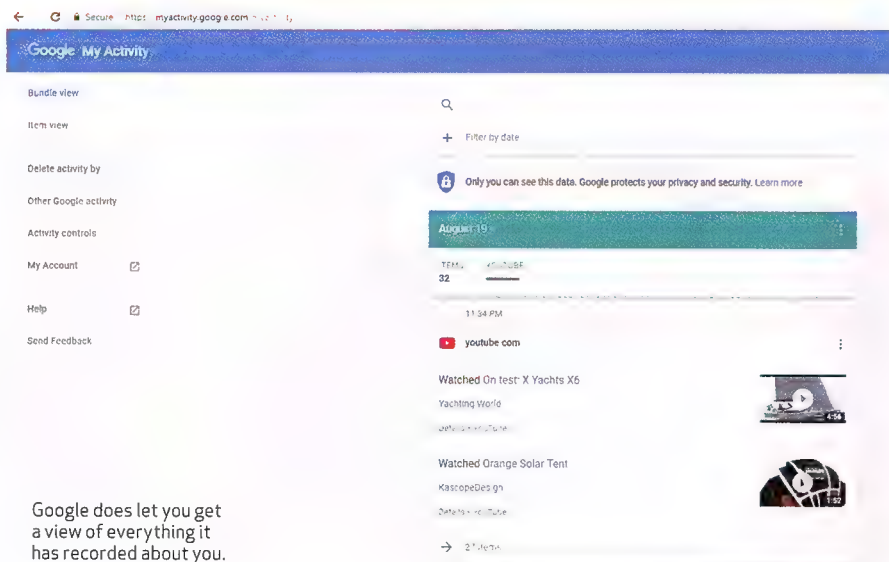
Unless you've been extra careful, it's probably fair to say that Google knows you just about as well as you know yourself. The internet giant hoovers up vast amounts of information on millions of users, ostensibly to deliver better ads (or, more accurately, to sell that user information to advertisers in order to better target ads).

This is especially true if you have a Google account. When you're logged into your Google account, Google will keep a permanent record of:

- Every search term you type into Google
- Every search result you click on
- Every YouTube search you perform and every video you watch
- Ads you click on
- A complete timeline of your movements by tracking your mobile's GPS
- Every time you issue an 'OK Google' voice command
- Potentially any time you visit a page with embedded Google services (like maps) and your complete Chrome browser history (thankfully this last one is turned off by default).

This information is recorded and attached to your personal Google account permanently. But even if you don't have a Google account or are not logged in, it will still gather information.

It records the IP addresses of people searching with Google and what they searched for. This data is kept for a period of time before being "anonymised" by deleting part of the IP address.



Its DoubleClick, AdSense and AdMob ad networks use tracking cookies and similar techniques to monitor app usage and movement between sites, too.

To its credit, Google does now give you tools to switch a good deal of that account tracking off – and that's more than can be said for some of its competitors, such as Microsoft and Facebook. We'll walk you through that process below, as well as give some extra tips for dodging Google's tracking.

DISABLING TRACKING AND RECORDING

Google now, thankfully, gives you the tools to delete your account records permanently, as well as turn off future tracking. You just have to know where to find the settings. Head to **myactivity**,

google.com and log in. It's here that you'll see the complete record of every bit of data Google has associated with your account, plus you can delete your records and stop future tracking.

The first thing we want to do is delete the archives. This will remove every item from Google's record about your activity. Now we need to say up front that we pretty much have to take it on faith that Google is actually deleting these records. The company has said that it does, although it notes that, in some cases, the records may still be stored on backup tapes and in archives.

Click on 'Delete activity by' on the left side of the page. Then under 'Delete by date', select 'All time' from the drop-down menu and click Delete. This will clear the records of your online activity up until now. You'll be asked to confirm.

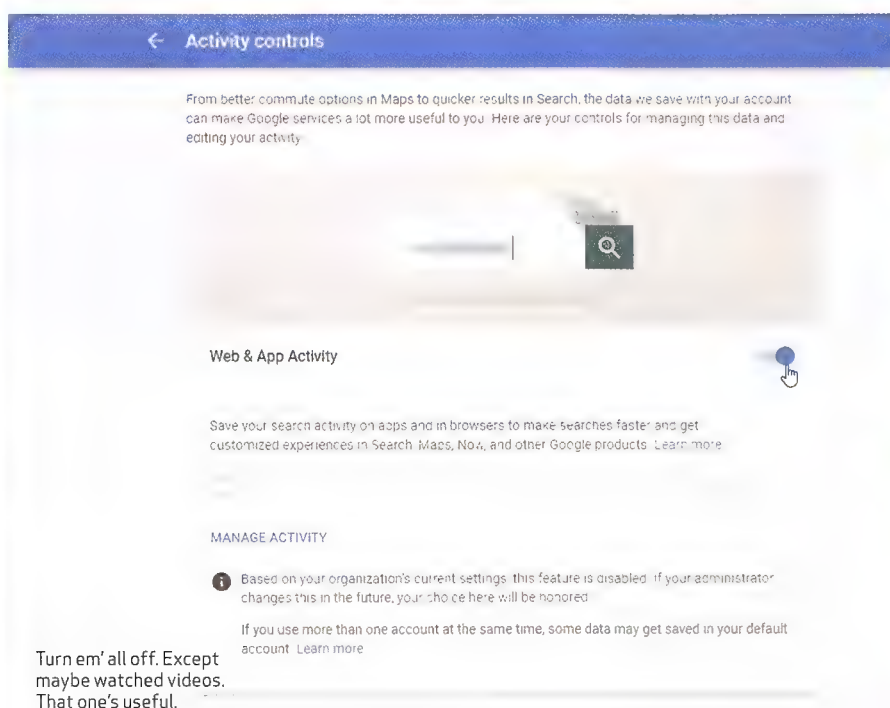
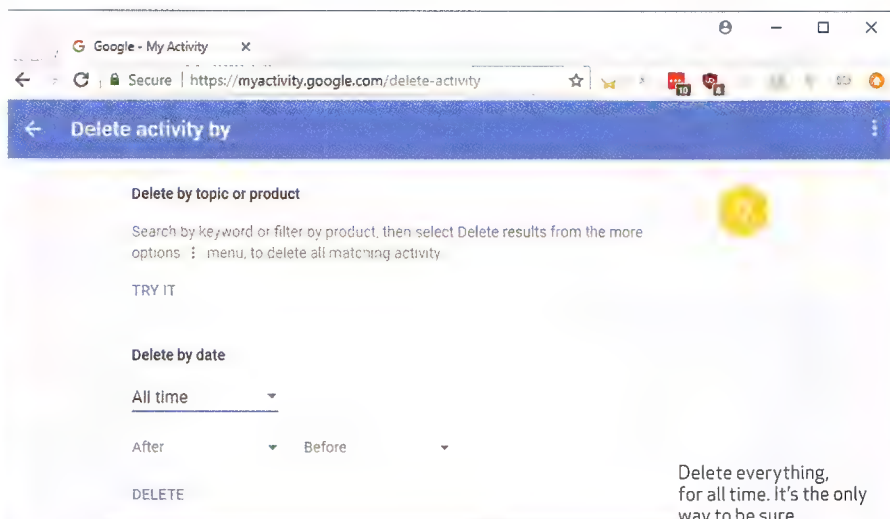
Now it's time to stop Google from gathering data in the future. Go back to the My Activity page, then click on Activity Controls on the left. This is where you can switch off all the logging that Google does.

Here, you will see a set of panels for different types of activity that Google records. There are panels for 'Web & App Activity', 'Location History', 'Device Information', 'Voice & Audio Activity', 'YouTube Search History' and 'YouTube Watch History'. In each panel, there is a blue switch. One by one, turn them to off

Facebook tracking

When it comes to tracking, Facebook (owned by company that you have probably heard of)

The omnipresence of Facebook widgets such as 'Like' buttons provides Facebook with incredible amounts of information about your online activity. Every time you visit a site with a 'Like' button, Facebook can know about it. And Facebook has not been as forthcoming about its tracking activity as Google, and it doesn't provide the same means of deleting and reviewing your records. Thankfully, the browser privacy add-ons like Disconnect and Ghostery are also effective against Facebook widgets. More on curtailing Facebook on page 64.



(which Google calls "paused"). You'll get a warning popup for each one.

The one exception you might make is watched YouTube videos. That's actually useful, since it determines YouTube recommendations. Once you've done that, Google should stop recording your activity in your Google account. It does not stop IP logging of searches (we'll get to that), and it will still keep some search information in cookies for the duration of a session, but your permanent account activity record will remain clean.

ANTI-COOKIE MEASURES

Now to stop the tracking that Google does regardless of your account settings or login status. First up, let's stop those cookies and analytics.

The best way to do that is with a privacy add-on for your browser. There are a number that get the job

done, but we've always liked Disconnect (disconnect.me). Another solid solution is Ghostery (www.ghostery.com). Installing these browser add-ons will block all tracking cookies from being sent by your browser. They also stop analytics and other tracking systems, like Facebook and Google widgets, from reporting your activity back to the mothership.

If you really want to kill ad tracking, you can also install uBlock Origin (www.ublock.org, which we now prefer to Adblock Plus) which will stop your browser from communicating with ad services like DoubleClick altogether.

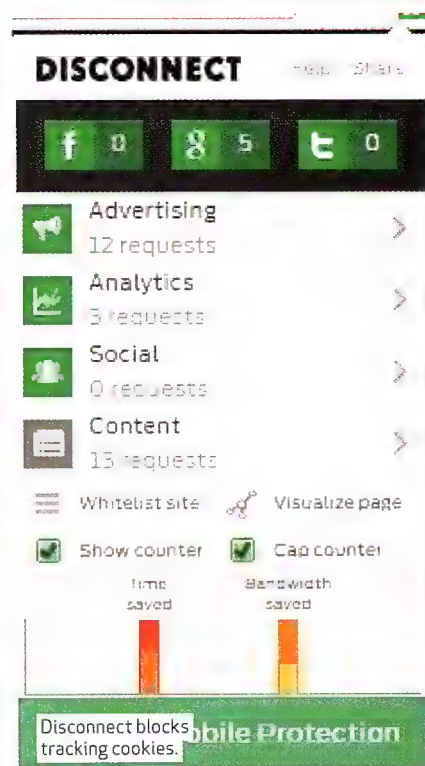
DODGING IP LOGGING

Finally, to deal with the fact that Google still links online searches with IP addresses, you can use a third-party search engine. If you still want Google's search results, we recommend

Disabling third-party cookies

Another thing you can do to stop ad cookies is disable third-party cookies in your browser — though installing Disconnect or Ghostery has much the same effect.

In Safari, they're actually disabled by default. In Chrome, you'll have to go to 'Settings > Advanced > Privacy and Security/Content Settings > Cookies' to find the switch to turn off third-party cookies. In Firefox, you have to go to 'Options > Privacy' and select use Custom settings for History to see the option to disable them. In Edge, go to 'Options > Settings > Advanced Settings' and select the option to 'Block' on 'Third Party Cookies' under 'Cookies'.



startpage.com. StartPage still gives you Google Search results. Except that it fetches those results for you like a proxy, so that you don't give Google your IP address. StartPage itself claims that it logs no IP addresses or search terms — but again, we take that on faith.

With all Google account tracking turned off, with ad cookies and analytics disabled, with Google widgets blocked and by using a third-party search engine, you should now be mostly clear of the Google octopus. Now you just have to figure out a way to stop Facebook and Microsoft... (See page 70.) ■

Stop Windows 10 from spying

The Creators Update has changed-up Windows' privacy options again — Joel Burgess and the APC team show how to lock them down.

The latest major patch for Windows 10 — aka the Creators Update — has made a good stab at streamlining the raft of additional security options that first became available in the previous Anniversary Update, but thankfully, there's still more than enough customisability to keep you feeling safe and protecting yourself from oversharing.

With a over 18 subcategories of privacy options, there's really a control for everything that you might want or need to shut off included in the options. In such a long list, however, that there are a few that aren't explained particularly well, so as a rule of thumb, just turn sharing off for anything you don't fully understand. Most software will prompt you to change particular settings if it requires special privacy privileges to work anyway.

1 START AT THE BEGINNING

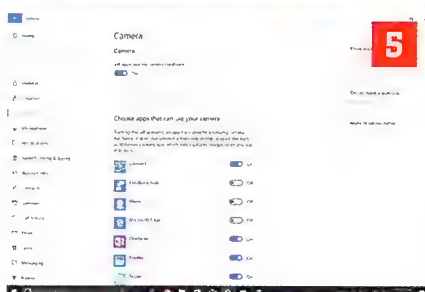
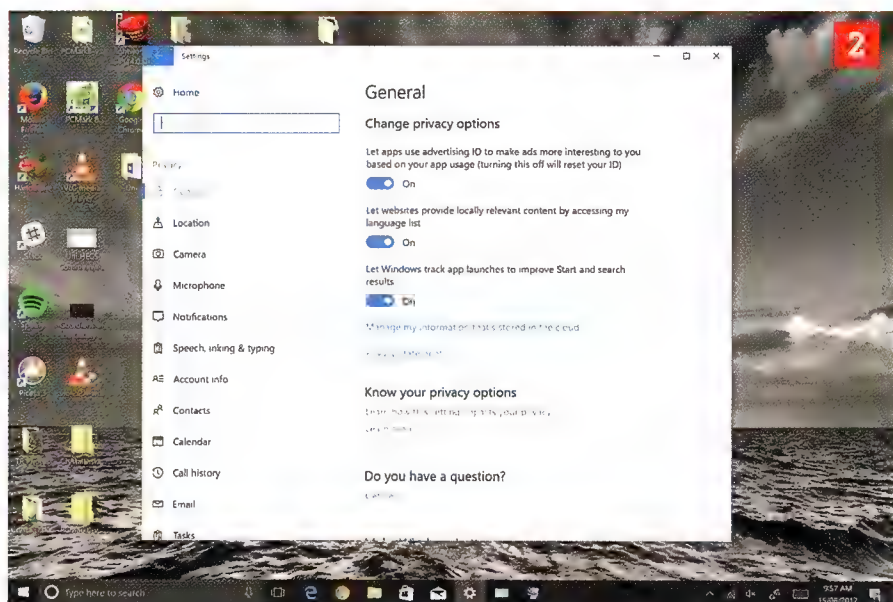
The Anniversary Update brought with it some great new security features that have stuck around in the subsequent Creators Update. In particular, the Windows 10 lockscreen allows you to hide your email address if you log in with an Microsoft account. Go to 'Settings > Accounts > Sign-in' options and scroll down to 'Privacy' to find it.

2 STOP ADS TRACKING YOU

From the main Settings app, you need to click on 'Privacy' to discover the main collection of privacy settings available. If you'd prefer advertisers were not able to track you using an anonymous tracking number, then set 'Advertising ID' to 'Off' and Windows will randomly allocate you a new tracking number each time you use the internet.

3 GENERAL PRIVACY

The first of the remaining two options in the General Privacy section concerns sharing the language (or multiple languages) that you configured Windows 10 in with the websites you visit, which is generally used to more accurately deliver local content. Finally, you can choose to allow Microsoft to anonymously monitor the apps you open, so it can streamline the search bar and Start menu configuration.



4 LOCATION SETTINGS

The 'Location' settings is worth visiting. Some apps, such as Maps and Weather, use your location in a helpful way — showing you the local area or telling you the forecast for where you are, for instance. That's why you probably shouldn't turn off location information completely, but instead choose which specific apps are allowed to access the data. Just scroll down and select the approved apps.

5 CAMERA AND MICROPHONE

The next two screens change how Windows 10 uses your webcam and microphone — if you have one installed. If you use services like Skype to video-call people, you probably don't want to block access to your camera or microphone, so it's a good idea to approve apps that can access your camera and microphone on a case-by-case basis — as in the previous step.



6 KEEP CORTANA IN LINE

Cortana's virtual assistant duties mean that it (and, therefore, Microsoft) is keeping close tabs on what you say. To improve Cortana's comprehension, data about your commonly-used vocabulary is stored in a personal profile. To turn this off, select 'Turn off services and typing suggestions', but bear in mind you won't be able to use Cortana at all if you do so.

7 ACCOUNT INFO

The Account window asks if you want to share your "name, picture and other account info" from your Microsoft account with apps. While there are bound to be apps that need this to get to the transaction stage, there are no specific apps that populate the 'Choose the apps that can access your account info' category and the vagueness of sharing 'Other account info' is a red flag to us. We'd turn this off unless it's specifically interfering with one of your apps working properly.

1 GENERAL PRIVACY
Click here to see general privacy settings in the Windows 10 Creators Update. From here, you can change how Windows 10 tracks you for advertising, or how it views the way you type and write in Windows.

2 LOCATION
Click here to change how Windows 10 monitors your location. If you regularly use apps such as Maps and Weather, you can still use them with location tracking off, though you will need to enter in the postcode of your location first.

3 SPEECH, INKING & TYPING
This is where the settings for configuring how Cortana (the virtual assistant) learns about how you use your computer. It can be a useful feature, but if you're concerned for your privacy, you can turn it off right here.

4 TOGGLES
Click these toggles to turn a setting on or off. Most settings are fine to turn off, but some might make Windows apps work incorrectly, so change these on a case-by-case basis.

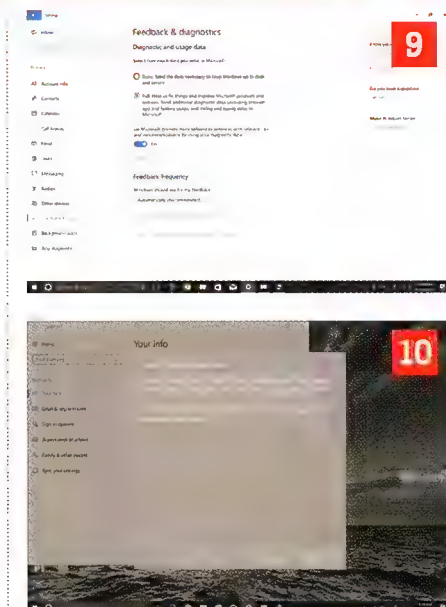
5 FIND A SETTING
This search box is useful if you are faced with a page full of settings and want to find something specific. Just type in what you're searching for, and Windows will take you there.

8 OTHER DEVICES
Not only does Windows 10 share your info with Microsoft, it can also share it with other devices connected to your Wi-Fi network or plugged into your PC. This makes using your machine with other devices easy and convenient. However, you'll want to check the 'Other devices' settings to make sure you know exactly which devices you're sharing information with.

9 OTHER PRIVACY SETTINGS
As a general rule of thumb, if there's not a good explanation of what you're handing over access to, or you just don't understand what you're signing away, then don't give Windows 10 the authority to share the information. While feedback and diagnostics of errors are generally

not something to be concerned about, you'll want to manually decide which apps you want to share your calendar, contact lists, call history, messages and Bluetooth control to.

10 USE A LOCAL ACCOUNT
If you want even more privacy, you can create a local account and use it with Windows 10, rather than an online Microsoft account. While this limits the functionality of some apps, it will make sure your privacy is under control. To switch to a local account, go to the main Settings window and select 'Accounts'. Click 'Sign in with a local account instead' and enter your password. ■





OPTIMISE THE WAY YOU USE WINDOWS

Nick Peers urges you to rethink how you use Windows 10 so you can speed things up.

Pin and organise app shortcuts to the Start menu.

We all want our PCs to run faster, but that doesn't simply involve fitting a new processor, doubling the amount of RAM, or tweaking system settings in an effort to boost Windows' raw speed. It also involves reappraising the way you use your PC, finding new shortcuts, and basically forcing yourself to work in a more efficient way. There are dozens of hidden tips and shortcuts that can revolutionise the way you interact with both Windows and your favourite programs, saving you a huge amount of time in a relatively short period.

How much time can you save? Taken in isolation, each tip we reveal

will probably shave a few seconds off here and there, but when you start using them regularly, things soon start to add up. Imagine: one tip that saves you five seconds, used 12 times a day, will save you a single minute, but over the course of a year, that adds up to six hours — from one tip. That means you don't have to apply that many of our recommended keyboard shortcuts and tweaks before your annual savings stretch into days and even weeks, simply by familiarising yourself with the content of this feature.

We focused primarily on Windows 10 here, although many of the tweaks and tips also work with Windows 7 and 8.1. We optimise the way you use the desktop, Start menu (and its hidden

little brother, the Quick Access menu), and Taskbar, plus reveal which Settings tweaks can streamline the way you work.

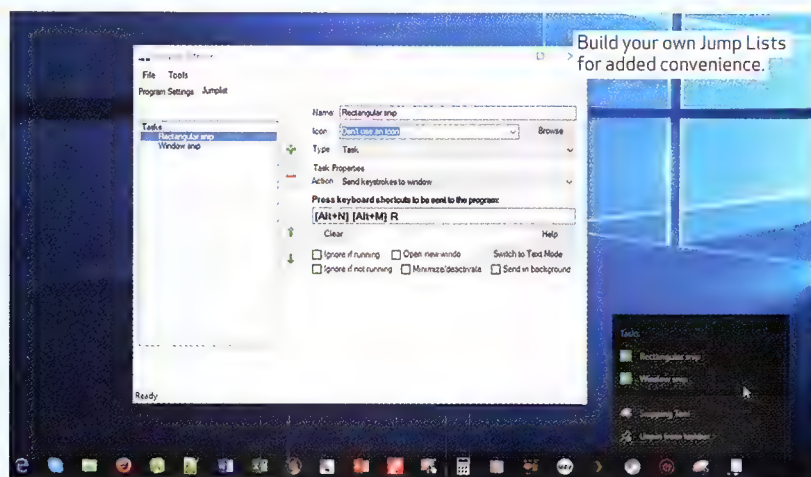
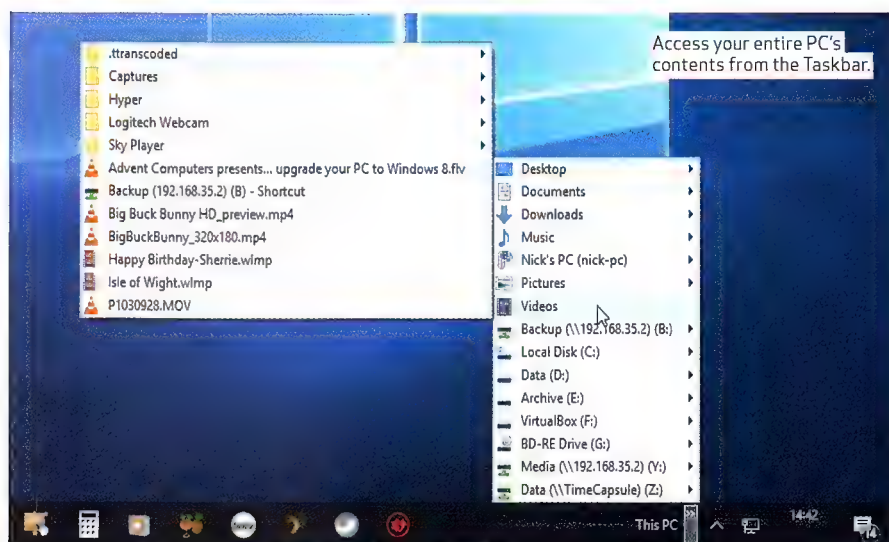
We also take you on a tour of timesaving keyboard shortcuts, investigate ways of using the right-click menu more efficiently, and unlock ways to search faster using File Explorer. There's even time to look at creating your own custom Jump List commands, reacquaint yourself with the Run dialog box, and speed up the way you use Microsoft Office (along with other apps).

With all that time waiting to be saved, don't delay — discover how to make your Windows PC even more productive right now.

Let's begin our efficiency drive by streamlining your desktop and making things more accessible. If you're not already doing so, start by placing shortcuts to your favourite apps on the Taskbar. This puts them a single click away — if you need to open a second instance of a program alongside the first, simply hold the Shift key as you click on the Taskbar icon to do so.

The simplest way to do this is to open the app in question — you'll see its icon appear in the Taskbar, so just right-click it, and choose 'Pin to taskbar', then drag it into place. You might, for example, want to group related apps together, so office apps in one part, web apps in another, and so on.

Another advantage to running apps from the Taskbar is that many use Jump Lists to give you two-click access



Create custom Jump Lists

Extend your application Jump Lists with Jumplist Extender (code.google.com/archive/p/jumplist-extender) — despite its age, this open-source tool works perfectly with Windows 10. Simply select your program, then create app-related tasks you can add to the list of options that appear in the program's Jump List. The best news? Jumplist Extender edits the Registry to create and edit your Jump Lists, so it doesn't need to be running for them to work.

For example, launch the program, and choose 'Start a new jump list'. Type "snipping" into the Search Programs bar, and select the Snipping Tool. Click 'Open' followed by 'Run Snipping Tool' to launch the program. When it loads, click the Snipping Tool window to select it, then click OK in the Jumplist Extender window.

Type "Rectangular snip" into the Name box in Jumplist Extender, then hold down 'Alt' and press 'N' — you'll see 'Alt+N' appear in the 'Press keyboard shortcuts' window. Now press Alt-M, then press 'R' on its own — it should now read '[Alt+N] [Alt+M] R'. You can add other screen-capture options with the right key combo by pressing the green '+' button — for example, '[Alt+N] [Alt+M] F' for a Freeform snip, or '[Alt+N] [Alt+M] W' for a Window snip.

Once done, choose 'File > Save and Apply to Taskbar'. Pin the Snipping Tool shortcut to the Taskbar, and close the program. Now right-click its Taskbar icon, and you'll see the options you've created, enabling you to capture screenshots without having to open the Snipping Tool first.

You can then apply this technique to any other program using keyboard shortcuts to trigger tasks (if no direct keyboard shortcuts exist, see the main text for the Alt workaround). Jumplist Extender can also be used to create a custom list of files to open using the program in question.

to recently opened docs — right-click the Taskbar icon to access them all. To permanently attach an item to this list, roll your mouse over it, then click the pin button that appears.

If you run out of space for items on the Taskbar, you could create a folder inside which you place all your shortcuts, then right-click the Taskbar and choose 'New > Toolbars > New Toolbar'. Point it to this folder, then you can click the '>>' next to the newly created toolbar to access your shortcuts. Or go further, and create your own custom Jump Lists with the help of Jumplist Extender (see boxout on left).



START MENU SHORTCUTS

The Windows 10 Start menu enables you to pin favourite items from the main list into the right-hand pane — just right-click the item in question, and choose 'Pin to Start menu' (you can also pin the item to the Taskbar from here via the More sub-menu). Once it appears in the list, you can then drag and drop related items together, change icon sizes (regular program shortcuts can be small or medium), then name the group for easy identification (click the '=' button next to a group to rename it). Also, click and drag the title bar via its '=' button to reorder groups, placing your more frequently accessed groups at the top of the list.

You'll also notice some handy shortcuts down the left-hand side of the panel — click your user photo to quickly access account settings via the 'Change account settings' option that appears (you can also switch users without logging out from here, too, plus lock your PC). Other shortcuts — including Settings and File Explorer — can also be found here. You have a limited choice of what you can display, including a selection of user folders

feature » optimise the way you use windows

(and indeed a link to the parent folder itself), Homegroup and Network. To change these, navigate to 'Settings > Personalization > Start', and then click 'Choose which folders appear on Start'.



USE QUICK ACCESS

The Start menu has been streamlined slightly in the Creators Update, but it's still no substitute for the Quick Access menu that appears when you right-click the 'Start' button or press 'Win-X'. This contains many useful shortcuts to various system settings and tools, but why stop with the options provided? You can add your own with the help of Win+X Menu Editor (winaero.com/comment.php?comment.news.30). This portable tool enables you to edit what's there, rearrange items and – crucially – add your own.

Once launched, click 'Add a program' to add your choice of programs, Control Panel items or Administrative Tools. Select 'Add preset' and you'll find some handy shortcuts to hidden tools and power options as well. You can also organise your items into groups to keep related items together, and make things easier to find.



MORE SETTINGS TWEAKS

The following tweaks all help save on clicks and unnecessary navigation, and can be found under 'Start > Settings' (or use 'Win-I' for even faster access). Start by heading over to 'Devices > Mouse' and – if necessary – flicking the 'Scroll inactive windows when I hover over them' switch to 'on'. You can now roll your mouse over any open window and scroll it, without first selecting the window in question. If you're a trackpad user, click 'Additional mouse options' and look for a tab that gives you access to specific gestures and other trackpad-only settings that can speed up how you use your PC.

If you regularly switch between printers, head to 'Devices > Printer' and enable 'Let Windows manage my default printer' – this makes whichever printer you use last the default. Select 'Typing' if you want to disable autocorrect and remove text suggestions, although in most cases these are welcome timesavers. Finally, select 'AutoPlay' if you want to pick a default option when you plug in external devices such as DVDs or flash memory cards.

Go to 'System > Notifications & actions' to tweak which Quick Actions appear in the Action Center – useful shortcuts include toggling quiet hours and tweaking network settings. Then select 'Multi-tasking' to change how virtual desktops behave – you can show open windows from all desktops

on the Taskbar to speed things up if you frequently switch desktops, plus configure 'Alt-Tab' to show all open windows, not just those open on the current desktop. More virtual desktop tweaks to come.

Go to 'Accounts > Sign-in options' and set a device-specific PIN to save you time whenever you're asked for your Microsoft Account password. Finally, it's also worth exploring the 'Ease of Access' section to see if any of the accessibility options on offer can improve your Windows experience to make things easier (and quicker) to use.



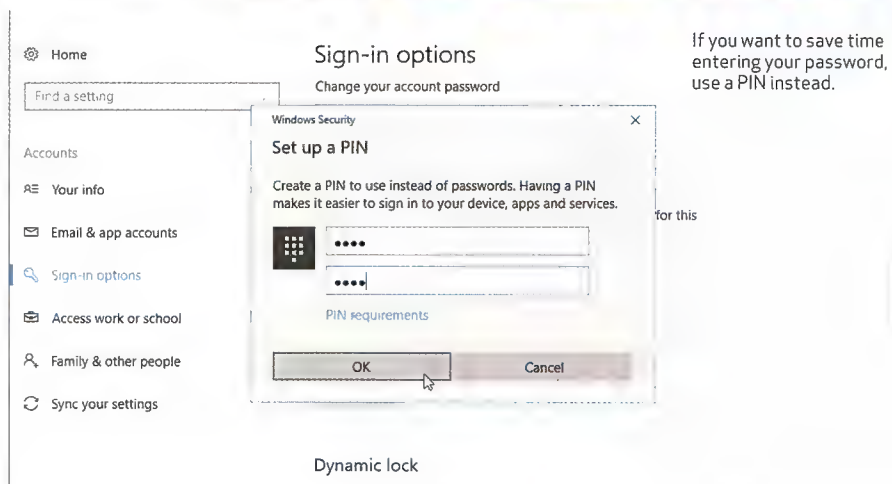
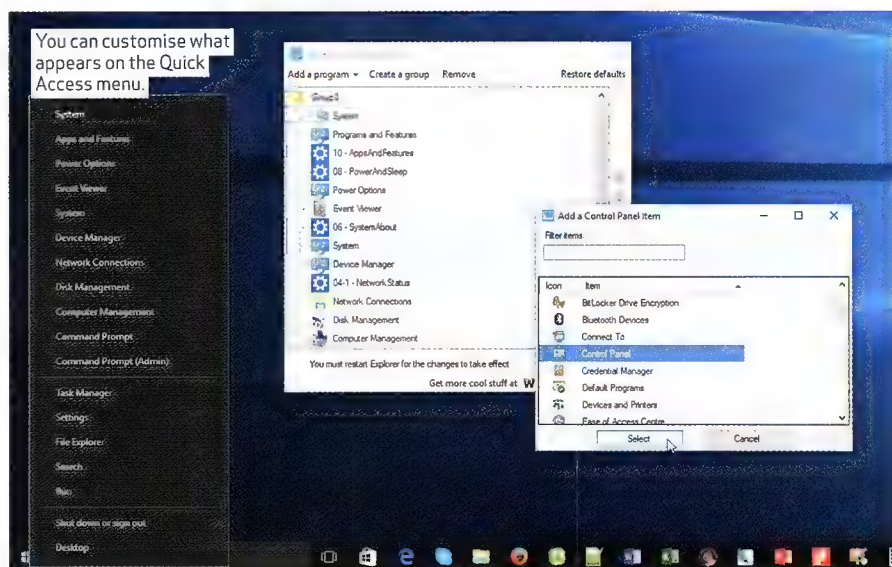
MASTER THE KEYBOARD

Point and click is convenient, but it's no substitute for fast keyboard action. Assign keyboard shortcuts to your favourite programs to quickly launch them. First, examine the Taskbar. The first 10 entries to the right of the 'Task View' button can be triggered using the shortcuts 'Win-1' through 'Win-0' (left to right). Alternatively, right-click a program shortcut (or right-click its Taskbar entry, then right-click the

program entry in the Jump List), and choose Properties. From here, click inside the 'Shortcut key' box, then hold down your choice of key combo to launch the app – it needs to be 'Ctrl-Alt', 'Shift-Alt' or 'Ctrl-Shift-Alt' plus your choice of key.

The Win key is also gateway to many useful tools: 'Win-Pause/Break' opens the old System Control Panel, for example, while 'Win-A' opens the Action Center. If you'd like to pair the Win key with Ctrl and Alt for more keyboard shortcuts, download WinHotKey from www.directedge.us/content/winhotkey, which works fine in Windows 10.

It's also worth exploring your favourite apps for useful keyboard shortcuts. There are some useful shortcuts universal to all apps (and Windows itself), such as the 'Ctrl-C', 'X' and 'V' shortcuts for copying, cutting and pasting to and from the clipboard. 'Ctrl-Z' undoes the last action (including file operations in Windows), while 'Ctrl-Y' redoes or repeats the last action. Most keyboard shortcuts are clearly labeled within a program's menu, but where no shortcut is



Use the Run Dialog

The old 'Start > Run' dialog may not be shown by default on the Start menu anymore, but it's still there (press 'Win-R') and it's as useful as ever. The more you use it, the better it becomes, because autocomplete kicks in, while typing paths is also quick, as all available sub-folders pop up as you type, helping you to locate and travel through your filesystem that little bit quicker.

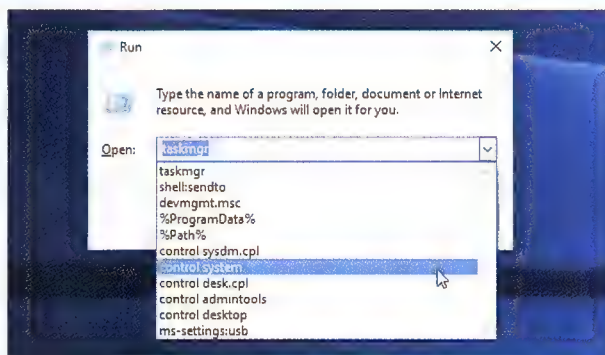
Let's start with a Windows 10-only tip. The new Settings menu can be labyrinthine to navigate, but the Run dialog gives you access to any section with the following syntax:

ms-settings:<shortcut>

You need to replace '<shortcut>' with your choice of location, such as 'ms-settings:windowsupdate', 'ms-settings:lockscreen' or 'ms-settings:display'.

The Run dialog also speeds up access to the Control Panel, although many of the shortcuts now redirect to their Settings equivalent, such as 'control desktop'. Those that don't include 'control admintools', 'control system' (System Control Panel) and 'control sysdm.cpl' (System Properties). See a full list at support.microsoft.com/help/192806. Others include 'devmgmt.msc' (Device Manager), 'taskmgr' (Task Manager), 'cleanmgr' (Disk Cleanup), as well as any program shortcuts or program file names (such as 'winword' for Microsoft Word).

One other major use for the Run dialog is to browse hidden user folders — specifically your application data folders.

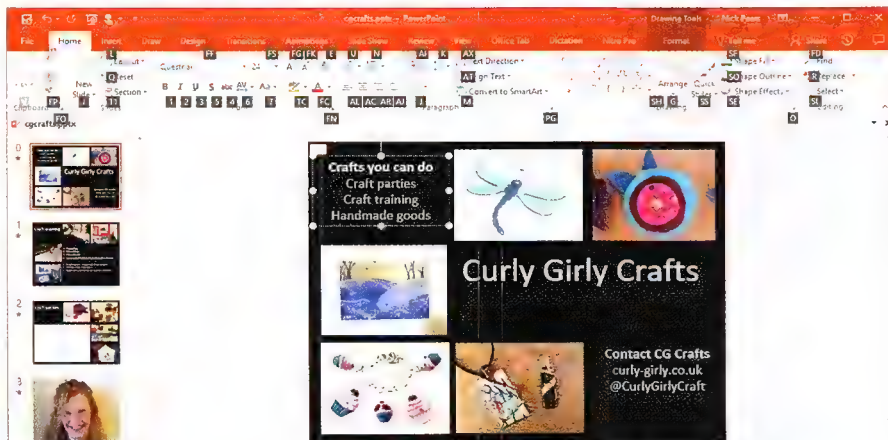
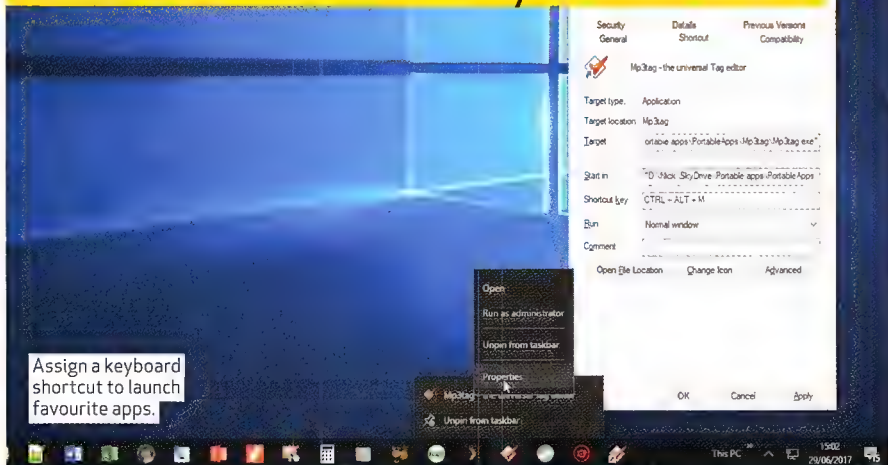


The Run dialog box is a timesaving superstar.

This is done with environment variables — %AppData% points to C:\User\<Yourname>\.AppData\Roaming, for instance, while %LocalAppData% redirects to C:\User\<Yourname>\.AppData\Local. Type "%AppData%" and you see a list of sub-folders — keep typing, and they filter down until you can select one.

Other environment variables include %windir% (your Windows directory, typically C:\Windows), %OneDrive% (your OneDrive folder) and %ProgramData% (the location of the ProgramData folder).

"Point and click is convenient, but it's no substitute for fast keyboard action."



The Alt key accesses menus and ribbons alike.

forthcoming, always remember the Alt trick — press Alt and the highlighted letter of a menu and you open the menu. Combine this with the underlined letter of a specific menu option — 'Alt-F-O' for 'File > Open', for example — and you trigger that menu option.

Office 365 users should press Alt once — you'll see a list of letters appear above the various ribbon and Quick Access toolbar options. Hold Alt as you press the corresponding key to access that option — if it's a ribbon tab, more letters appear next to various ribbon options, enabling you to select those options quickly, too. For more Office tips, see the boxout opposite.



USE RIGHT-CLICKING

The right-click menu — also accessible by pressing 'Shift-F10' to trigger it at the current cursor point — is packed full of useful, context-sensitive options, particularly in File Explorer. Hold down Shift as you right-click, and you often reveal hidden options — 'Copy as path' for a selected file or folder, and loads more destinations under the 'Send to' sub-menu.

To add your own custom apps and locations to the 'Send to' menu, open the Run dialog, type "shell:sendto" and hit Enter. Place your shortcuts in here, or use SendToToys (www.gabrieleponti.com/software) to add loads more options, such as clipboard, Command Prompt and so on.

The right-click menus can become cluttered by third-party apps adding

their own options, which can slow navigation down. If there's no option to disable these within the application itself, there are a few third-party tools that can help clear the clutter for you. If you're using CCleaner (www.piriform.com), then go to 'Tools > Startup > Context Menu tab'. If you want more control — including options for adding more entries to the menu — then use the portable Context Menu tool (www.sordum.org/7615/easy-context-menu-v1-6) instead. Choose 'File > ContextMenuCleaner' to review and scrub unwanted entries.



SPEED UP FILE EXPLORER

File Explorer is packed with timesaving tips and tools. Here are some of the best.

First, make use of the Quick Access menu in the Navigation pane — drag frequently accessed folders here for quick and easy access.

If you're still using Ctrl or Shift to select multiple folders or files, switch to the View tab of File Explorer's ribbon instead, and select 'Item check boxes' — now you can simply select each file or folder by using its checkbox.

File Explorer's search box is still the go-to location for file and folder searches — learn to make the most of its filters to find what you need. The Search tab on the ribbon provides you with two-click access to these, but you can quickly input your own filters directly into the search box, including "type:" (filetype), "kind:" (type of file, such as document), "date:" (date or date range), "size:" (file size) and "tag:" (tags).

The Search box also supports all standard Boolean operators, so enclose exact phrases inside double quotation marks, precede unwanted terms with a dash (-), and use 'AND', 'OR' or 'NOT'. Visit msdn.microsoft.com/aa965711 for a comprehensive guide. If you store key files outside of your

user folders, it's worth getting Windows to index those locations to speed up future searches. On the Search tab, choose 'Advanced Options > Change indexed locations' to do so.



WINDOWS DESKTOP

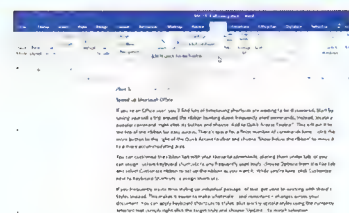
Let's finish with some handy keyboard shortcuts for navigating your desktop.

Aero Snap enables you to pin two windows side-by-side by dragging them to either edge of the desktop. You can also snap windows via the keyboard. Hold Win and press left or right cursor keys respectively. Once there, press 'Win-up' to move the window to the top corner or 'Win-down' to move it down to the bottom corner, allowing up to four windows to be on screen at once.

Finally, start making good use of Windows' task- and desktop-switching tools with the help of some Tab key combos. The new visual Task View may not be to everyone's tastes, but you can invoke it with 'Win-Tab'. Once open, use the cursor keys to select your desired window, and hit Enter. If you prefer the old-school view, hold down 'Alt' and press 'Tab' instead — cycle left and right using 'Tab' (right) and 'Shift-Tab' (left), all while continuing to hold the Alt key.

'Alt-Tab' only displays windows from the current virtual desktop, while you can configure Task View (see earlier) to display windows from all desktops, making it quicker to switch. Speaking of which, hold 'Win-Ctrl-D' to create a new virtual desktop, and 'Win-Ctrl-F4' to close the current one. Move between virtual desktops using 'Win-Ctrl-left/right' cursor keys.

As an aside, if you're navigating a multi-tabbed application, such as your web browser, then use 'Ctrl-Tab' and 'Ctrl-Shift-Tab' to cycle backward and forward through the tabs. ■



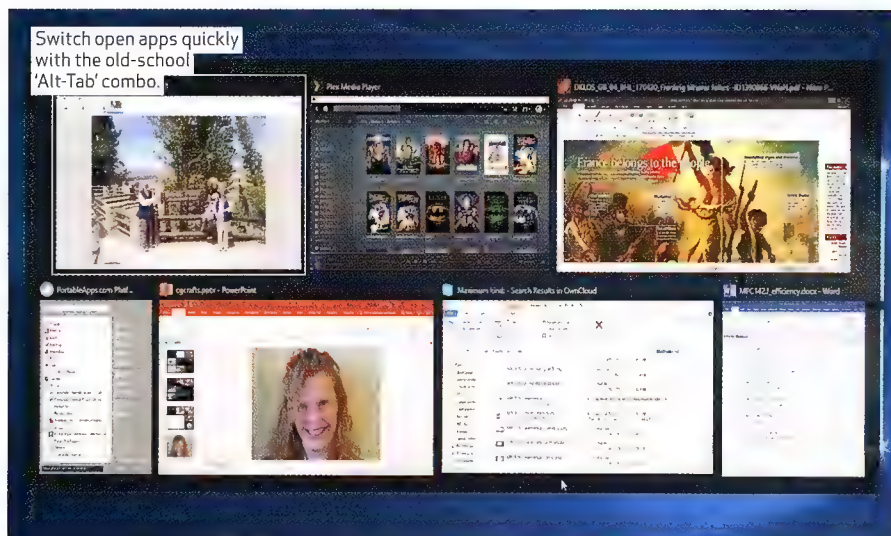
Speed up Microsoft Office

If you're an Office user, you'll find lots of timesaving shortcuts are waiting to be discovered. Start by saving yourself a trip around the ribbon hunting down frequently used commands; instead, locate a popular command, right-click its button and choose 'Add to Quick Access Toolbar'. This pins it to the top of the ribbon for easy access. There's space for a finite number of commands, so click the 'More' button to the right of the Quick Access toolbar and choose 'Show below the ribbon' to move it to a more accommodating area.

You can customise the ribbon with your favourite commands, too, placing them under a tab, or you can assign custom keyboard shortcuts to any frequently used tools. Choose Options from the File tab and select 'Customize ribbon' to set up the ribbon as you want it. While you're here, click Customize next to 'Keyboard Shortcuts' to assign shortcuts.

If you frequently waste time styling up individual passages of text, use Word's Styles instead. This makes it easier to make wholesale — and consistent — changes across your document. You can apply keyboard shortcuts to styles, plus quickly update styles using the currently selected text (simply right-click the target style and choose 'Update... to match selection').

Finally, save time performing repetitive tasks by recording them as macros. The simplest way is to use the 'Record Macro' button on the Developer tab of the ribbon to record your command clicks or keystrokes — note it only works with items selected using the keyboard, which can restrict its usefulness somewhat. Go to support.office.com and search for 'macros' to find out more — be aware that macros can harbour malicious code, so only allow macros that are digitally signed, by clicking 'Macro Security'.





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OFFICE APPS

TROUBLE WITH MAIL CONFIGURATION

I'm trying to use Mail in Windows 10 and cannot make the server alterations required to send mail through another account. Where can I find them, please?
Colin Travis

Sadly, it isn't possible to configure an email account in Mail to send messages through a different mail server, so instead, we pointed Colin towards eM Client, which is available at www.emclient.com. To do this, go through the eM Client setup wizard to configure your account and you should find that it will fail the sending mail test. At this point, you may be prompted to enter your outgoing account credentials, but if not, click the Menu button and choose 'Tools > Accounts'. The next step is select your account and then switch to the SMTP tab to input the details of your outgoing server. Here, choose 'Use these credentials' before inputting your new email account's username and password. You'll now be able to send your emails.

Rob Mead-Green

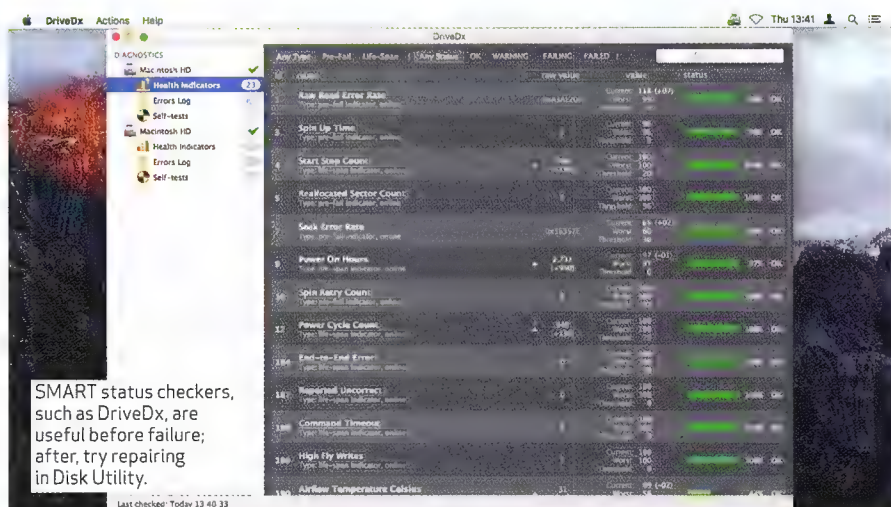
MAC

EXTERNAL DRIVE TROUBLE

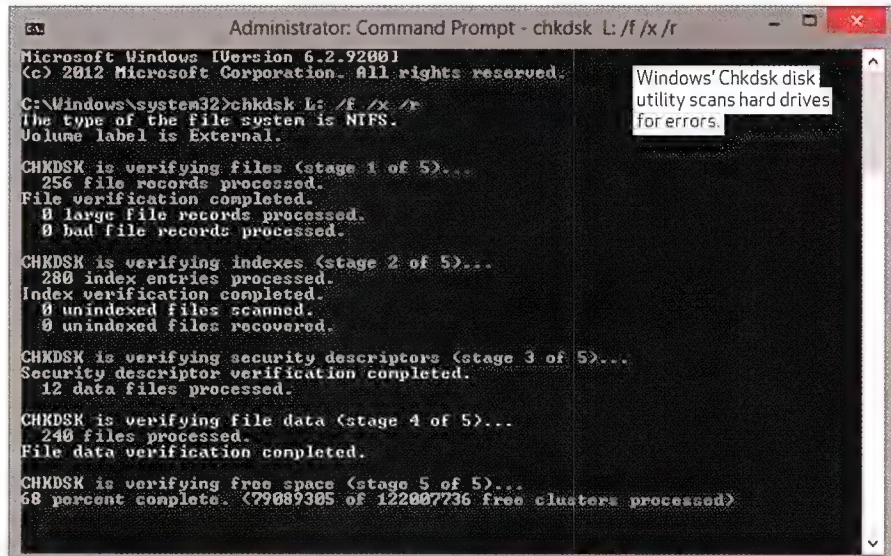
When my iMac crashed today, its logs were full of "Failed to composite image for descriptor" error messages prior to forcing its shutdown. I also saw some repeated errors from the kernel about a "disk1s2: I/O error". I've only recently upgraded to El Capitan: does this indicate an incompatibility with it?

Mark Syder

The upgrade process may have brought on your problem, but the more critical and worrying of those error messages are those relating to disk1s2, which is likely to be an external hard drive. Input/output errors like this are normally the result of a serious issue with a drive, possibly even complete drive failure or a defective electrical connection. Ensure both ends of the drive's connecting cable are fully inserted into its ports, and that the cable is a good one. Check the drive using Disk Utility first, and perform



SMART status checkers, such as DriveDx, are useful before failure; after, try repairing in Disk Utility.



any necessary repairs. If that reports a SMART status error or other hardware failure that can't be fixed, eject the drive and shut it down immediately. Several utilities, such as the excellent DriveDx, can provide you with more details about SMART warnings, errors and other faults, but once your drive has failed, there is little point in holding a post mortem. If the drive hasn't died, it might still be recoverable. When you have a replacement, you might be able to salvage the old drive's contents and copy them over to your new one. Unfortunately, sudden drive failures

can still be the cause of crashes, although OS X is getting more resilient to such hardware issues.
Howard Oakley

WINDOWS

WINDOWS KEEPS CHECKING DRIVE ON STARTUP

I have been spring-cleaning by running the Chkdsk tool on my hard drive, and now it's continually running it at startup. How do I prevent this?
Hannah Eastwell

Sometimes Chkdsk can get stuck in a loop even if there isn't a problem with the drive. We instructed Hannah to click 'Start > Settings > Update & security > Recovery' and click 'Restart now' under the Advanced start-up option. At the recovery menu, choose 'Troubleshoot > Advanced Options > Command Prompt'. Windows will reboot and you'll need to select your username and enter your password. When the prompt appears, type the following, substituting 'c:' for whatever drive letter you are scanning: 'chkdsk c: /f /r /x'. On running the command, Hannah reported that Chkdsk made a minor correction, but more critically, it also stopped trying to run at every boot. Nick Peers

SOFTWARE
PANDA ANTIVIRUS KEEPS PROMPTING TO ACTIVATE

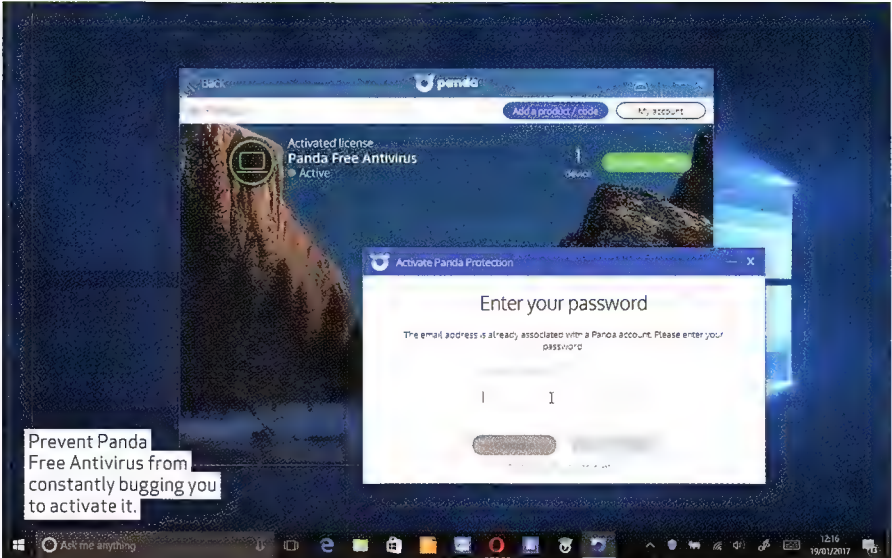
I've downloaded and installed Panda Free Antivirus (from www.pandasecurity.com), and activated an account via email — or so I thought. Yet the antivirus software keeps prompting me to activate my account whenever it starts up. Can you offer any assistance please?
Ergin Vlietstra

This sometimes happens if Panda isn't aware you've clicked the link in the email (perhaps you accessed the email on a different computer). Thankfully, it's straightforward to fix. When you next see the "Don't forget to validate your Panda account" message, click 'Want to use another email address'. Leave your existing email address in there, but type in the password you created when setting up your Panda account. Click Continue, and the program should finally register your activation.
Mayank Sharma

LINUX
GRAPHICAL VIRUSES?

I've tried installing ClamAV as I have a dual-boot PC (with Windows 7). First, I used a DVD to upgrade from Ubuntu 14.04 to 16.10 then added Ubuntu. After installing ClamAV, I have no GUI I can invoke from Dash!
Simon Bateman

ClamAV is a command-line tool and this is what the clamav package installs. There are two other packages you need to install. The first is clamav-freshclam, a tool to regularly update ClamAV's database of virus signatures. The other one is clamtk, the GUI. You can use ClamAV from the command line with `# clamscan --recursive /mnt/windows`. The `--recursive` (or `-r`) switch tells clamscan to scan all the sub-directories of the given path, otherwise it scans only the files in that directory.

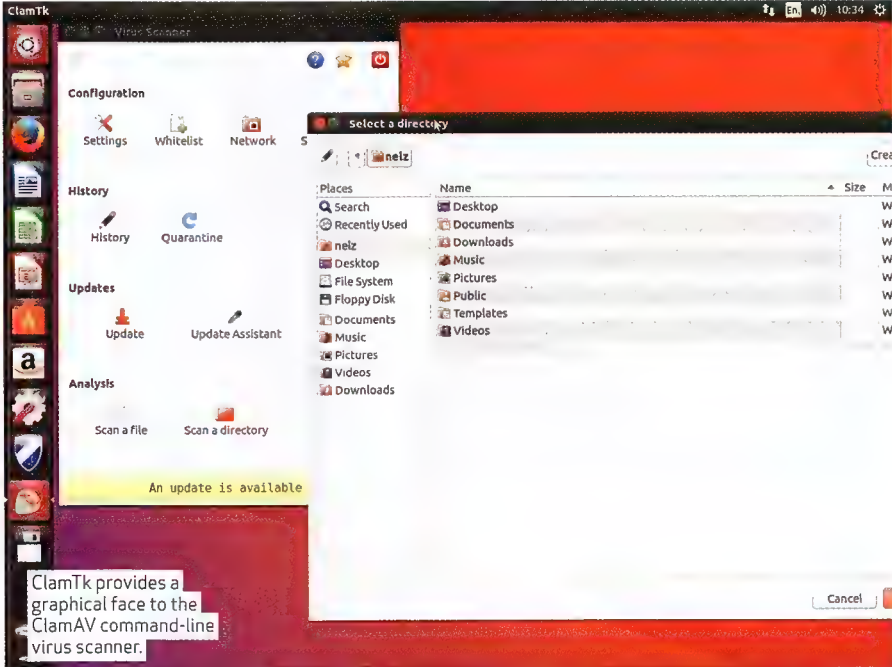


Obviously, if your Windows partition is mounted at a different location, you should change the above path. Clamscan doesn't need special privileges to run but it must be able to enter all the directories and read all the files it scans, so you may need to run it as root depending on how the filesystems you want to scan are mounted. Once you've installed ClamTK, it should be available from Dash and you can scan files or directories, as well as perform other functions from the GUI. You may be wondering why we've bothered with instructions for the command-line client when the GUI you wanted is available. The reason is that the command-line version can be scripted. Otherwise, you have to remember to run the GUI and scan your directories at sufficiently regular intervals. But the OS has a tool, called Cron, that does all that remembering

and running for you. Almost anything you can script can be run from Cron. So if you create a shell script (as below) to run clamscan and put it in the /etc/cron.daily directory, it will be run every day:

```
#!/bin/sh
clamav --recursive --quiet /mnt/windows
```

We use the `--quiet` option so it only gives output if it finds something suspicious. Set the executable bit on the file and save it in /etc/cron.daily and your system will be checked every day. To make sure you're kept informed of the results, you should have the output from the command emailed to you by editing /etc/crontab (as root) and adding the line `MAILTO=your@email.address` right after where SHELL and PATH are set. Of course, you can still do manual checks with the GUI, especially if the automated scan highlights anything.
APC Team



Advanced image editing in Apple Photos

For more ambitious photographers, Photos has some powerful editing options, says Dave Stevenson.

Photos, Apple's bundled OS X app for sorting your images, does some amazing jobs automatically. Sorting images by their geo-tags, dates and auto-detecting faces and assigning identities spring to mind, and that's before you consider the computational gymnastics required to sync the photo library on your Mac with your iCloud account and Apple mobile devices.

Still, while you might be aware that Photos can be used to edit your images, for most, that stops at relatively straightforward changes such as rotating and cropping, or perhaps applying a few one-click filters. Here, we'll look at the editing tools you might have missed. Tools that can elevate a good photo to a great one, or rescue a shot that was otherwise destined for the bin.

Thinking about getting an expensive third-party editor? Hang fire until you've read this.



How to use Photos to make subtle changes



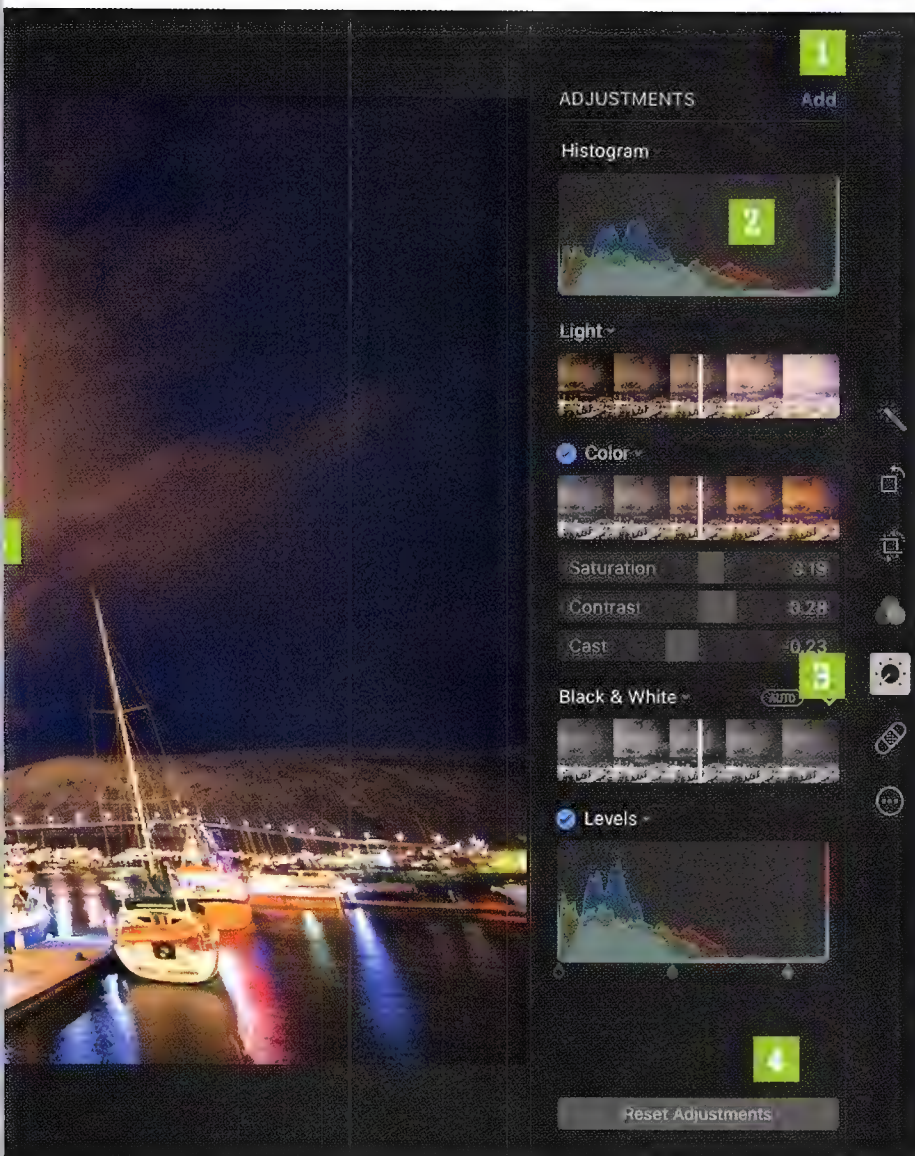
1 CLEAN UP

Dust spots are the bane of SLR users' existence. Here, two particularly fine splodges are ruining our shot. Click the edit icon to get the toolbar up. Click the sticking plaster icon on the vertical list of options, then drag the mouse over your dust spot.



2 SAMPLE SELECTION

The tool works by sampling a nearby area of your shot and copying it over your dust spot. To change where Photos samples from, Option-click the place you want to copy pixels from. Drag the slider, or press [or] to adjust the size of the brush.



1 CHOOSE TOOLS

The most crucial button — use this to choose and add new tools to Photos' editing palette.

2 THE HISTOGRAM

The histogram is not turned on by default, but is a very useful tool once you start editing.

3 MORE OPTIONS

You see that little down arrow? Any time you see that, Photos is hiding more detailed options. Click it and see what you can do!

4 REVERT

Made a mistake? No sweat. This handy little number takes you back to square one.

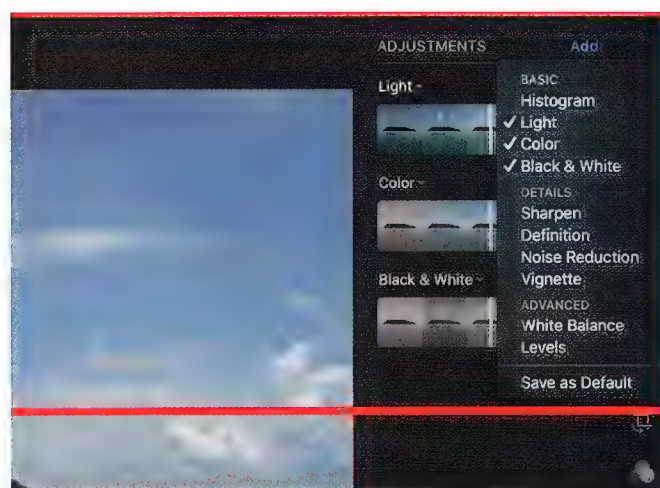
5 LIVE PREVIEWS

Changes are previewed live, so it's easy to make sure you're happy before you export a finished version of your shot.



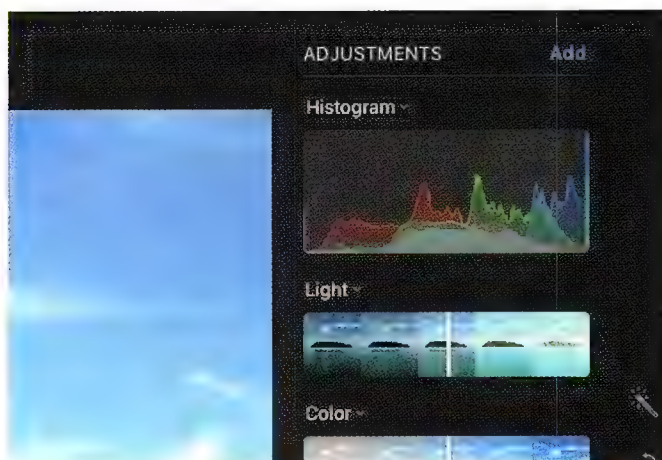
3 STRAIGHTEN UP, FLY RIGHT

Wonky horizons are a regular issue in landscape photography, so hit the crop icon and click and drag the rotation wheel on the right-hand side of your image to straighten it up. The grid that appears should help you get the horizon straight.



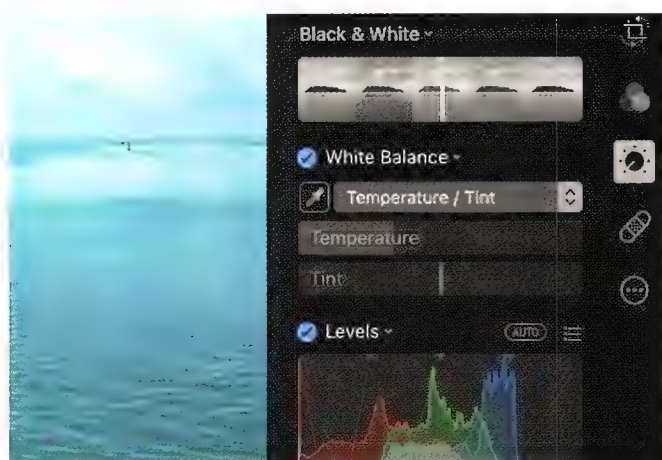
4 ADD TOOLS

Click Adjust for access to the really tasty tools. At first, you'll only see Light, Colour and Black & White — the first two are layman's terms for exposure and saturation, but click Add to see a list of other options.



5 ADD THE HISTOGRAM

A histogram is a useful way of assessing the changes you're making. The graph is a representation of the brightness of your image: if all the wavy lines are clipped off the right side of the graph, your image is over-exposed. Vice versa and it's too dark.



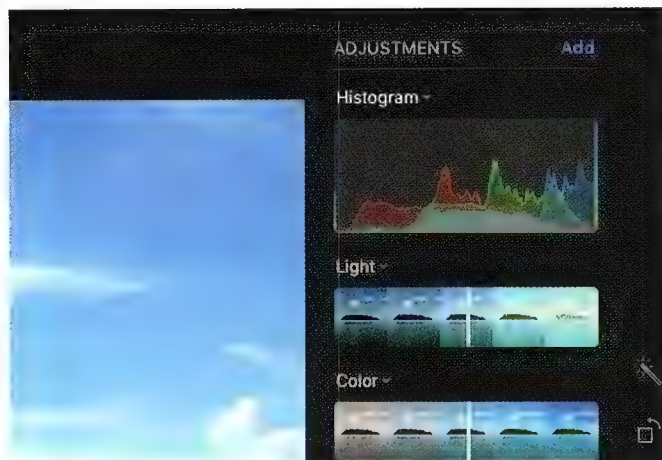
7 WHITE BALANCE

White balance is typically used when you've been shooting in mixed-light indoor environments, but it can be useful elsewhere. Dragging the temperature slider left will cool your image; the opposite direction warms it up.



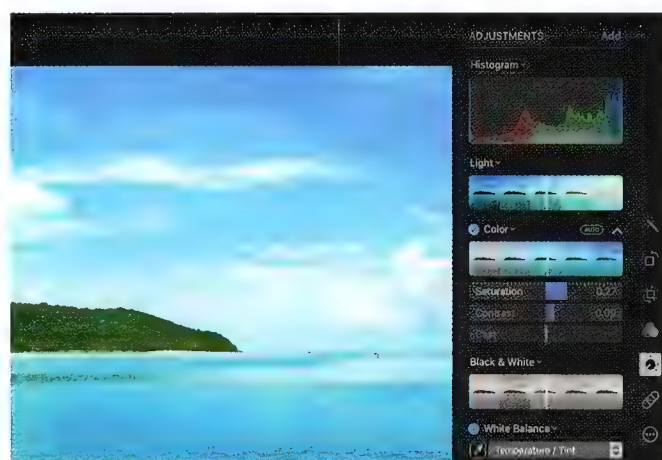
9 ...TOO MUCH

This is what happens when you go big guns on the saturation sliders. A very dramatic image, but one that will, unfortunately, look pretty crazy if you try to print it. Keep your edits subtle for the best effects!



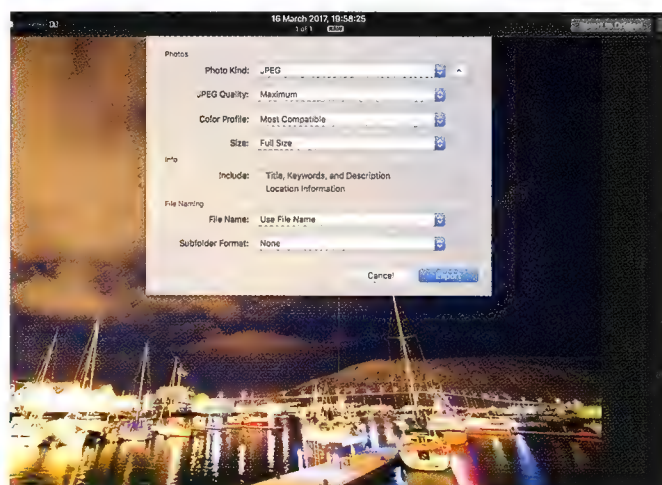
6 ADD LEVELS

Add the levels tool, and click and drag the left-hand handle until it's directly under the beginning of your histogram. Do the same for the right-hand slide. This will quickly get the darkest parts of your image black and the brightest bits white.



8 ADD COLOUR...

You can warm up an image using white balance, but using the Color slider is a great finishing touch to your edits. Use the drop-down arrow to break Color down into contrast, saturation and cast for more control.

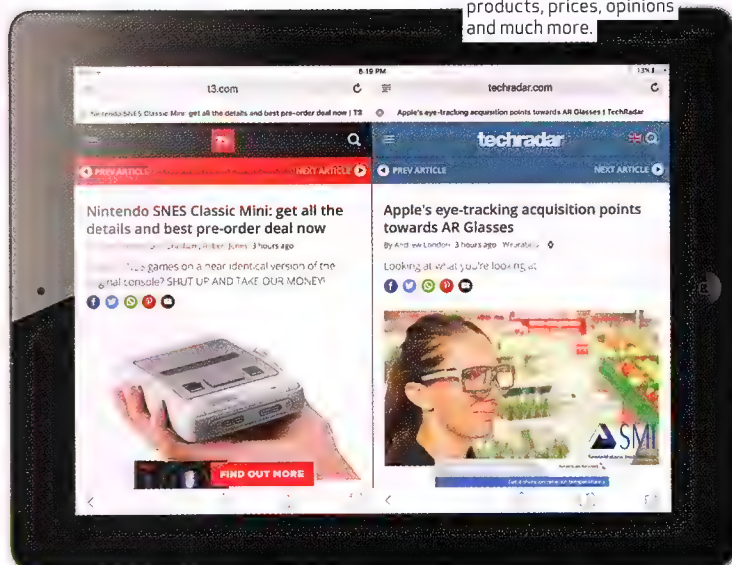


10 GO BACK IN TIME

Click Done to save your changes (you can return to the edit screen at any point and click Revert to Original to restore your shot). Alternatively, select your shot and choose Export to create a copy with your edits for use outside Photos.

Master Split View on iPad

Nick Peers shows how you can view two web pages side by side in Safari on iOS 10.



In iOS 10, Apple extended the Split View feature for working in two apps side by side, so that you can view two web pages next to each other in Safari. You can quickly split the screen in two from scratch or open a link or move an existing tab to the right half of the screen. If you've connected your iPad to a Bluetooth keyboard, you can quickly create a new Split View pane using 'Command-N'.

Split View only works with your device in landscape mode, however, and you can't resize the panes. With a second pane open, you can tap Private

to set it to private browsing mode without affecting the other one. Once in Split View, each pane behaves largely as normal – you can open multiple tabs in each one, though you may need to use the forward/back buttons to navigate your browsing history.

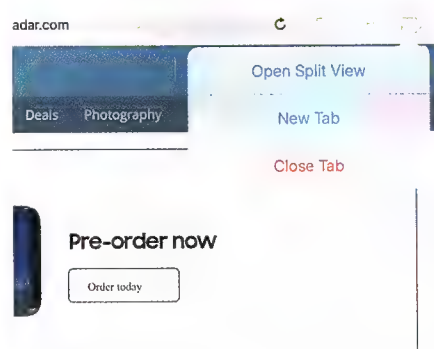
You can easily move tabs between panes – just drag one across to the other side of the screen. (Note: if one pane is in private browsing mode and the other isn't, this won't work.) To open a link in the opposite pane, hold a finger on a link and choose 'Open on Other Side' from the pop-up menu.

Finally, should you want to revert to a single pane, you have two choices: the first is to combine all the tabs from both panes in one. To do this, hold the 'Show All Tabs' button – there's one at the end of the toolbar in each pane – and choose 'Merge All Tabs' from the pop-up menu that appears. Every tab you had open will remain, and a single page will again fill the screen's width.

If you want to close Split View without retaining the tabs from one of its panes, you can close all the tabs in the unwanted pane at once. Again, hold a finger on the 'Show All Tabs' icon and choose 'Close <number> Tabs.'

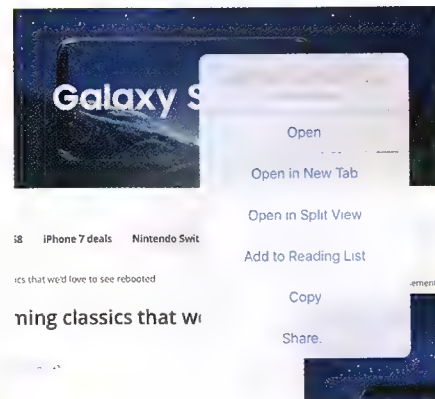
How to

Invoke Split View on your iPad...



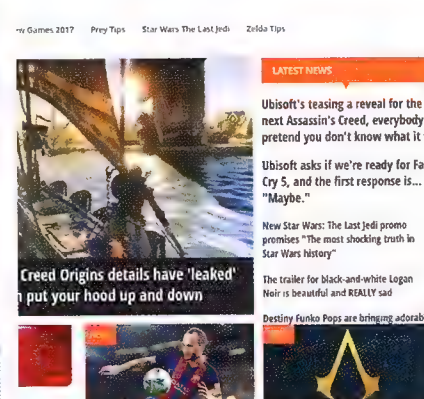
1 OPEN A BLANK TAB

In Safari, hold a finger on the 'Show All Tabs' icon (two overlapping squares) until a pop-up menu appears. Pick 'Open Split View' to split the screen in two – your current page on the left, and your home page on the right.



2 OPEN ANOTHER PANE

If you want to open a link to an interesting page alongside what you're already viewing, hold a finger on it, then choose 'Open in Split View' from the pop-up menu. The new page opens on the right side of the screen.



3 CONVERT TAB

If you've got two tabs open already, switch them to split-screen view by dragging one down off the tab bar and then to the right or left edge of the screen. Let go when you see the main view shrink a little. ■



Secure your Linux system

Reading Sun Tzu is just the first step in tackling those who seek to harm your Linux machines. Shashank Sharma reveals what you need to do next.

There's an entire thread on Reddit discussing whether Professor Alastor 'Mad-Eye' Moody, from the *Harry Potter* books, ever uttered the catchphrase, "Constant vigilance!" Regardless of who to attribute the statement to, if you're concerned about securing your Linux installation, whether as a home user or a system administrator, it's good advice to adopt this mantra.

The entire gamut of operations that you can employ to defend yourself from threats are spread over the next few pages. We will walk you through creating a digital moat around your machines to stop the marching invaders in their tracks. This involves using password managers such as KeePass2, using secure login, working with ClamAV to detect trojans, viruses and malware, and more. We'll also show you how you can make life easier for yourself by automating a number of essential tasks, such as monitoring the ports for scanners using tools like Nmap and implementing tools such as logcheck and logrotate to make sense of all the logs that are generated by various apps and services. Along the way, we'll help you deploy a rootkit

checker, discuss various password-strengthening measures and lots more. Finally, we'll discuss the projects that are working towards making Linux even more secure for servers and networks and the efforts being made to make the kernel robust.

While we're using Linux Mint for this feature (which is on the cover disc), all the tools discussed here can just as readily be used on any popular distro such as CentOS, Fedora, Mageia, Ubuntu, Debian and so on.

But first, baby steps. These are the tricks that you can and must adopt to secure your machines. If you're interested in protecting a relative's desktop which they use to browse the internet for their daily dose of entertainment or world politics, even these changes should be enough to set your mind at peace.

The first step is to choose the right distro. Sounds rather silly, but there's a reason why you should give serious thought before settling on any Linux distro. You must consider whether the distro has a dedicated team working on pushing regular bug fixes and security updates. This is important, because in recent years, many security

weaknesses in popular Linux apps and services such as Samba have been found and unless you plug these your system is at risk. As a further precaution, you can also disable or uninstall services that you don't need. For instance, if you only have a single machine at home and haven't configured it for printing, you don't need CUPS or the Samba services.

Another trick to employ is to opt for encryption. Most Linux distros nowadays allow you to encrypt your home folder during installation itself. You can also optionally use apps such as zuluCrypt to configure encryption on your current installation.

It's imperative to not use dictionary words nor keywords such as 'qwerty' or 'god111' as your passwords. The safest option is to ensure that passwords are reset regularly, and you can program your system to reject passwords that users have used previously.

Throughout the next few pages, you'll find helpful hints and sometimes detailed instructions on how to adopt many of these principles into your Linux installation, apart from all the other advanced tools and tricks which you can use to thwart attackers.

To secure your machines, you must adopt a two-pronged strategy against potential attacks. The first involves preparing against intruders by installing a firewall and adopting better password policies. But this alone isn't enough. It's one thing to lock all the windows in your house, but you must still make sure no one got in before you closed them.

SECURE LOGINS

Trusting passwords to hold all your data is foolhardy. To prevent unauthorised access to your machine, you can add an extra layer of authentication. One of the easiest methods is by using the Google Authenticator service, which issues a time-based authentication token to supplement the existing password challenge.

You can configure the utility for all configured users on your Linux machine, and each will receive the OTP on their configured Android devices. Unless a user enters the token that quickly expires, they can't log in. If you've configured your machine to allow remote logins, you can also configure Google Authenticator to work with SSH.

To implement this multi-factor authentication with Google Authenticator, you'll need the Google Authenticator PAM module. PAM stands for 'pluggable authentication modules' – a mechanism for plugging different forms of authentication into a Linux computer.

STRONGER PASSWORDS

The `libpam-pwquality` tool is another such module that you can use to

improve your passwords. Open the `/etc/pam.d/common-password` file in your favourite text editor and identify the line that reads `password [success=1 default=ignore] pam_unix.so obscure sha512`. Add the `minlen` parameter to the end of the line if you want users to choose passwords with a minimum-length `password [success=1 default=ignore] pam_unix.so obscure sha512 minlen=8`.

If you similarly want to ensure that users choose passwords with a mix of upper/lower-case letters and special characters, throw in parameters such as `lcredit=-3 ucredit=-2 dcredit=-2`, which forces users to respectively use three lower-case letter, two upper-case letters and two digits. You can install it using the `sudo apt install libpam-pwquality` command from the terminal.

CHECK FOR ROOTKITS

The password tricks discussed here, coupled with using a firewall and regular system updates, are a good start to protecting your system, but hackers often employ other means to do you harm. A common attack strategy used by attackers is privilege escalation, wherein after gaining access to the machine by compromising your password or installation of malicious script, an attempt is made to gain root access such that more harmful operations can be carried out. A rootkit is a script or program designed to gain unlawful root access for nefarious purposes.

Quick Tip: Unique passwords

Use the `remember=X` parameter in the common-password file, which is used to store X number of previous passwords and ensures users don't reuse any of them.

One of the most popular rootkit scanners is `chkrootkit`. You can easily install it from the terminal with the `sudo apt install chkrootkit` command. Once installed, you can invoke it with the `sudo chkrootkit` command. The tool is designed to scan your machine for a host of known rootkits and malware. Run the `chkrootkit -l` command for a list of all the tests the utility runs by default. Keep in mind that the process can take some time, depending on your system configuration and available resources.

A common trick adopted by rootkits is opening ports, which would allow an attacker entry into your system. You can scan your system for open ports using the Nmap utility. You can scan for ports by specifying a range or scan all of them with `nmap -p 1-65535 localhost`. The full range of Nmap's capabilities are too vast for us to list here. Refer to the manual (use `man nmap`) for details on getting the most out of it.

As a further precaution, you must also install the ClamAV app, which can detect trojans and viruses. If your setup involves Windows and Linux machines, it's also recommended to install Linux Malware Detect, a malware scanner for Linux which even allows users to submit suspected malware for review.

"It's one thing to lock all the windows in your house, but you must still make sure no one got in before you closed them."

Identify issues

Formerly known as `rkhunter`, Lynis is one of the most popular security auditing tools for Linux. Although favoured by sysadmins, it's a must-have tool if you're running a server or allow remote access through SSH while its ease of use and simplicity of operation can also help home users.

Lynis will study the config files of the installed applications, report user accounts without passwords, check firewall rules, identify expired SSL certificates and much more. In all, the tool will run hundreds of tests on the host machine, but it doesn't require any extra software. Rather than automatically addressing problems, it generates a report listing all the

identified issues and provides tips on how to harden the system more effectively.

You can grab the latest version of Lynis with git clone github.com/CISOfy/lynis, which will fetch the latest version into the `lynis` directory. The tool doesn't require any installation, so you can begin using it by switching into the `lynis` directory and running the `./lynis audit system` command.

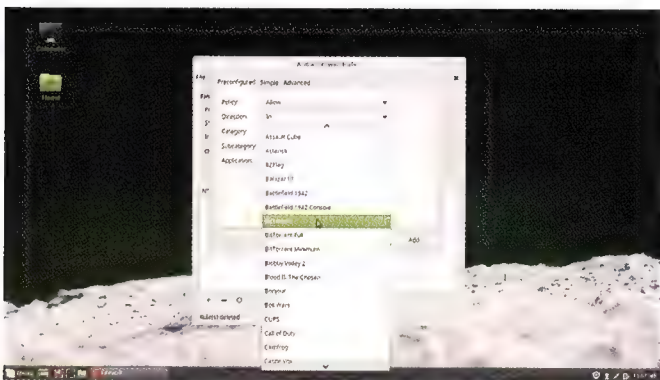
When running the scan, Lynis will output the result of every performed test to the screen, but you must interpret the result yourself and take appropriate actions.

Use the Gufw firewall



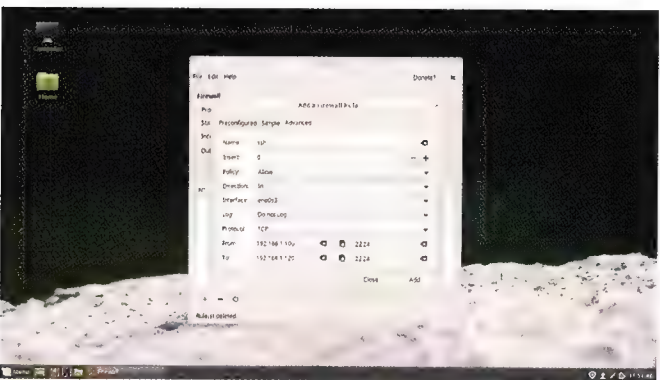
1 ENABLE THE FIREWALL

Gufw is the graphical front-end for UFW, the uncomplicated firewall, which is one of the simplest front-ends for iptables. Fire up Gufw and change the Status toggle to 'On' to enable the firewall. Gufw includes three profiles: public, office and home. The default is the home profile that denies all incoming traffic and allows all outgoing traffic. This will let you surf the internet without any issues.



3 PRECONFIGURED RULES

After you've set the policy for traffic, you can define specific rules for allowing traffic for individual apps and services. To create a rule, switch to the Rules tab and click on the '+' button. Use the Application pull-down in the Preconfigured tab to select the app you want to allow and Gufw will define the most effective rule for that app. Then press the 'Add' button to append the new rule.



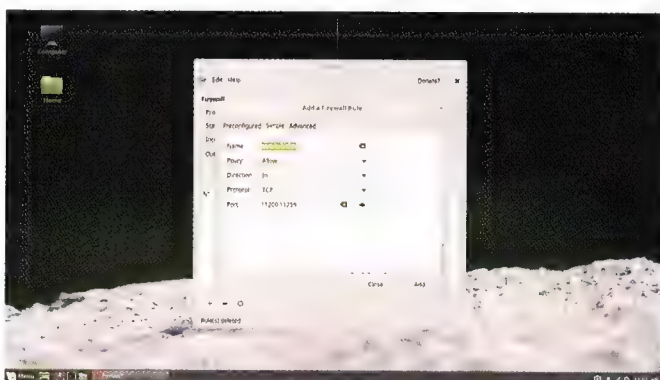
5 MORE CUSTOMISATION

The Advanced tab is useful if you need to make minute customisations as per your requirements — for example, if you only wish to allow the SSH service from computers within a particular IP address range over a particular interface. Since the firewall matches traffic against rules in ascending order, you can also manually give your custom rule a number to specify its position in the list of firewall rules.



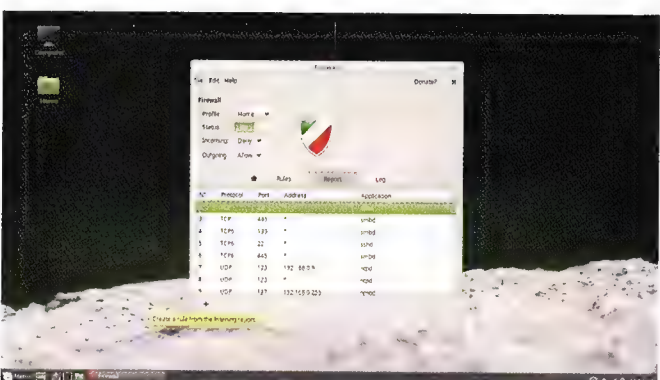
2 DEFINE POLICIES

You can alter the incoming and outgoing policies by selecting one of the three options in their respective drop-downs. The Allow option will allow traffic without asking any questions. The Deny option will silently discard packets, while the Reject option also sends an error packet to the sender. A good idea is to deny all incoming connections and then selectively enable the ones you wish to allow.



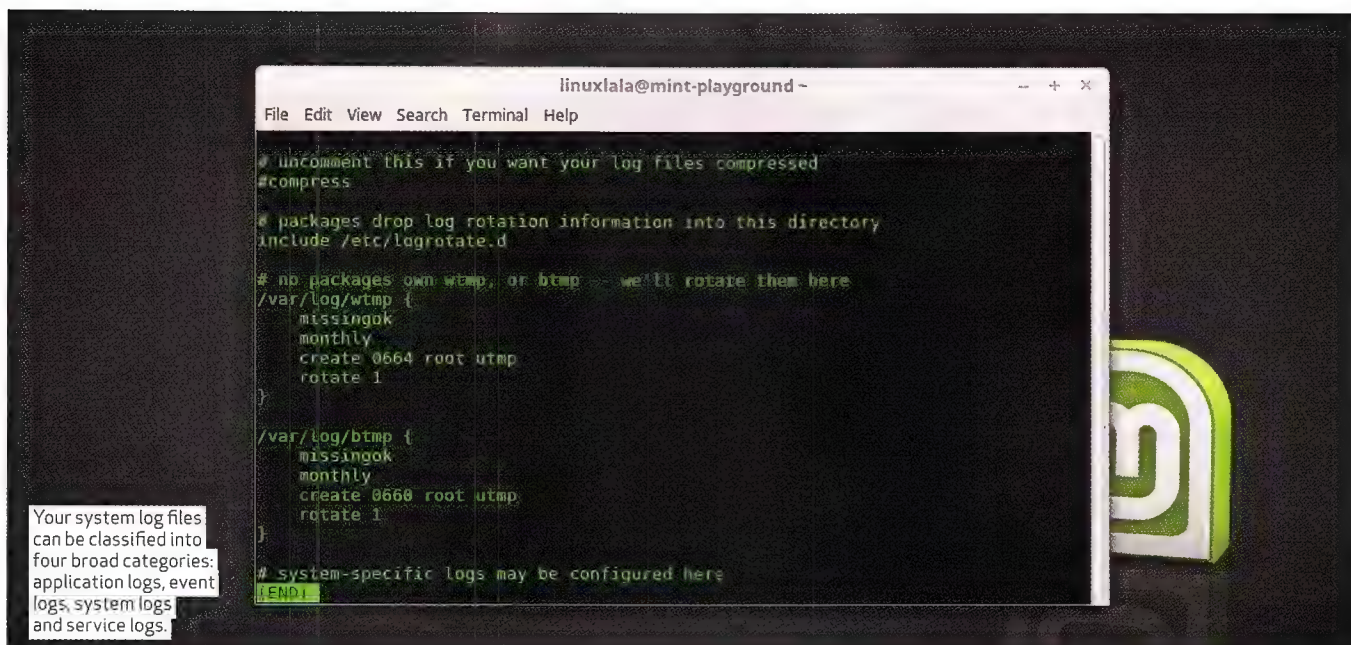
4 CUSTOMISE RULES

Gufw enables you to tweak the default rules, which comes in handy especially when you're running a service on a non-default port. Switch to the Simple tab, which is similar to the Preconfigured tab but instead of a drop-down list of apps, it allows you to manually specify the port number for the service. You can either add a specific port (23) or a range of ports (11200:11299).



6 WATCH INCOMING TRAFFIC

One particularly useful feature of Gufw is the live listening report. After you've added the rules, switch to the Report tab that'll list all traffic along with other relevant information such as the protocol, port, IP address and application. You can use this info to adjust the rules particularly for incoming traffic. Then there's the Log tab which keeps track of Gufw's activity and helps identify any suspicious activity.



The security of a Linux machine involves more than mere installation of software. It requires active participation to monitor the log files and other reports generated by the host of tools and apps deployed. You must also interpret the reports and, where necessary, take further steps to deter attackers. Unless you're willing to do all this, you'll quickly end up with a machine that's host to all manner of suspect activity.

But don't panic. You can help yourself by automating a number of these tasks.

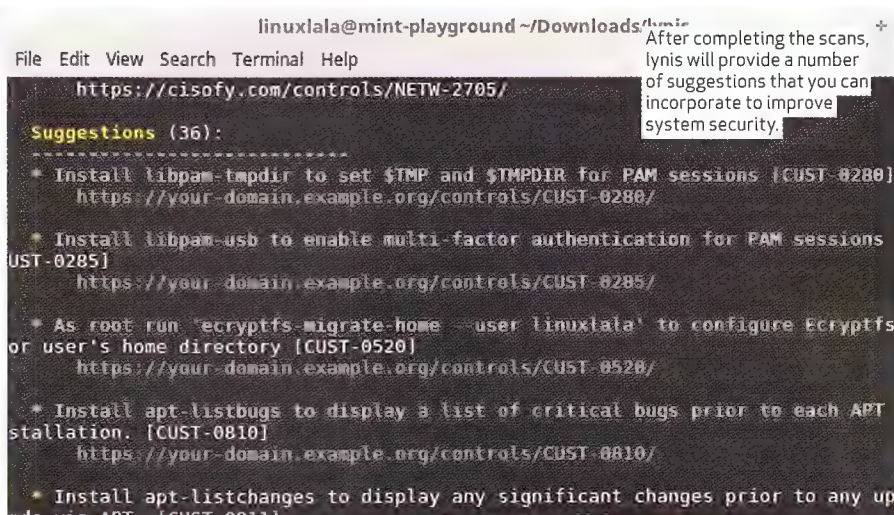
AUTOMATE SYSTEM MONITORING

A network analyser, often referred to as a sniffer, is a program that collects and gathers all network traffic. You can use it to determine if a malicious entity is attacking or has attacked your network. When your machine is set in promiscuous mode, the network interface will collect all network traffic passing through that interface.

You can use the 'ngrep' tool to watch your network in real time. It even enables you to separate packets based on specific parameters. The simplest way to use it is to run the ngrep command in the terminal to watch all traffic passing through the network. If you've never used the tool before, it's best to study the output of ngrep, initially. Later on, you can begin playing around with different filters, which allow you to focus on packets based on host, type, protocol or direction (of traffic). You can use: `ngrep port number > /tmp/ngrep-logfile` to dump the traffic details to a log file and study it later.

CREATE CRON JOBS

Cron is a time-based scheduler which you can use to run defined operations at a specific time and date. It is



commonly used to perform routine tasks such as backups. Every scheduled operation is referred to as a cron job. You can create such cron jobs to ensure your system isn't compromised by scheduling lynis and chkrootkit to be run daily.

You can create cron jobs using: `crontab -e`. This opens a the crontab file in a text editor and you can then add tasks. The syntax of a cron job is: minutes hours day month day_of_week. That is, you can define the minute, hour, day, month, day of the week when each task should be run. It's best to schedule chkrootkit to run daily. You can configure it to run at 1am everyday by adding the following to the crontab file:

```
0 1 * * * /usr/sbin/  
chkrootkit 2>&1 >chrootkit_log
```

WORK WITH LOG FILES

Your Linux system, the myriad applications and tools, and many

everyday operations such as software management all generate log files. These are useful for three main reasons. They can help you troubleshoot system problems, such as the reason why a software installation failed. Next, logs can serve as an early warning system for security events. From a security point of view, if you are convinced your system has been compromised, logs can help you with performing forensic investigation.

You can only rely on the logs to determine something is wrong if you're familiar with what the log reads like during normal system operation. It is imperative to be able to distinguish normal activity as opposed to someone trying to attack the system. You can only do this if you don't just collect logs, but regularly study them too!

When dealing with logs, you must also have a thorough policy in place with regards to various factors such as frequency of logging. You should also routinely back up log files,

as comparing current logs with the archive can help you detect nefarious activity. At the same time, you can't retain log files indefinitely, as they can take a large amount of space over a period of time.

MANAGE LOG FILES

You can use logrotate for easy management of log files. It supports automatic rotation, compression and mailing of log files and can be configured by editing the `/etc/logrotate.conf` file. The logrotate utility enables you to define the frequency of rotation, whether weekly or monthly, and the number of log files to be used for each log. You can also set different parameters for different log files and define whether a log is to be rotated based on its size, and the period for which a rotated log file is to be stored.

For example, if the rotation is set to 10 for the `output.log` file, the logrotate utility will automatically create `output1.log`, `output2.log` and so on until `output10.log`, while the latest logs will be stored in `output.log`. The man page has more details and you can find detailed instructions and examples easily on the internet as the utility has been around for ages.

Another popular tool is logcheck. It is designed to periodically scan all the logs – it starts the scan where it left off last time, saving crucial time. The highly configurable tool lets you define the frequency of checks, the log files to be checked, what is considered normal and not, and where to email the alerts. You must define the normal behaviour which the tool can ignore, otherwise you'll be inundated with alerts.

SEARCH LOG FILES

Another important tool in the arsenal of log watchers is swatch. It works by looking for the specified regular expressions and promptly informs you when a match is found.

The user invoking swatch must create a `~/swatchrc` file which describes the ignore and 'watchfor' directives as well as the notification email address. The watchfor entry is a list of keywords that you want to be alerted about as soon as a match is found. You must be familiar with regular expressions to get the most out of swatch. Also your system must be configured to send mails to local users, as well as to an internet domain, if you want emails sent to external services such as Gmail.

Once configured, you can use swatch to monitor a number of logs for essential keywords.

Safer surfing

Essential browser extensions

Naturally, you must be cautious when downloading files. Fortunately, there are several helpful extensions available for Firefox and other web browsers.

1 HTTPS Everywhere: Available for Firefox, Chromium, Opera and many other browsers, it ensures all communications with websites are SSL-encrypted.

2 Ghostery: This extension disables trackers on websites like Facebook and Google such that data is not collected even after you navigate away from the sites, as is increasingly becoming the norm.

3 NoScript: Disables all scripts such as Flash, Java, JavaScript and other executable content on a web page. It enables you to create a whitelist of trusted websites, like your bank, but takes getting used to.

4 WOT: Web of Trust maintains a list of trusted websites. For each website you visit, a green icon indicates a trustworthy site, yellow tells you to be cautious and red indicates potential danger.

5 BetterPrivacy: LSOs are 'super-cookies' that can contain more detailed information, including your browsing preferences. With BetterPrivacy, you can choose to delete LSOs at fixed time intervals.

The screenshot shows the 'myfavouritemagazines.co.uk' website. The main header includes the site name and navigation links like 'All Magazines', 'Offers', 'Single Issues', 'Specials', and 'Magazine Search'. A banner for 'Linux User & Developer - Print' is prominent, featuring a magazine cover and a 'feefo' service rating. Below the banner, there are two steps: '1. Select your delivery region' and '2. Select your subscription', with options for 'Quarterly Continuous Credit Card' and 'Credit/Debit Card or PayPal 1 Year'. On the right side, a 'Basket (0 item)' is visible, and a list of blocked domains is shown, including 'Mark myfavouritemagazines.co.uk as Untrusted', 'Mark optimizely.com as Untrusted', 'Mark feefo.com as Untrusted', 'Mark issuu.com as Untrusted', 'Mark bing.com as Untrusted', 'Mark facebook.net as Untrusted', 'Mark dnn506yrbagrg.cloudfront.net as Untrusted', 'Mark isu.pub as Untrusted', 'Mark scorecardresearch.com as Untrusted', 'Mark hotjar.com as Untrusted', 'Mark quantserve.com as Untrusted', 'Mark dwin1.com as Untrusted', 'Mark google-analytics.com as Untrusted', 'Mark googleadservices.com as Untrusted', 'Mark googletagmanager.com as Untrusted', and 'Forbid Scripts Globally (advised)'.

So far, we have discussed a number of tools and practices that you can adopt to secure your system and prevent attacks, but there's still plenty more that you can do, depending on whether you're interested in protecting your server or your network, or even a home workstation.

The entire gamut of available solutions can very well lead to a troubling case of paralysis from analysis, which is why we listed some of the best protective tools. But there's still more that various other projects and entities are working on to protect your machine from harm.

The Linux Security Modules (LSM) framework allows the Linux kernel to support a variety of security models to implement mandatory access control (MAC). SELinux and AppArmor are two of the most popular LSMs on Linux. While the former allows you to define the activities which can be performed by each user, process or daemon, AppArmor can be used to restrict each installed program using application-specific profiles. Container vendor Docker is also working on another LSM called Landlock, although it's still at the nascent stage.

Apart from these, there are a large number of updates that ship with each new Linux kernel which fix many identified issues to keep you safe. On top of that, the Kernel Self Protection Project was started to provide additional layers of security to the Linux kernel.

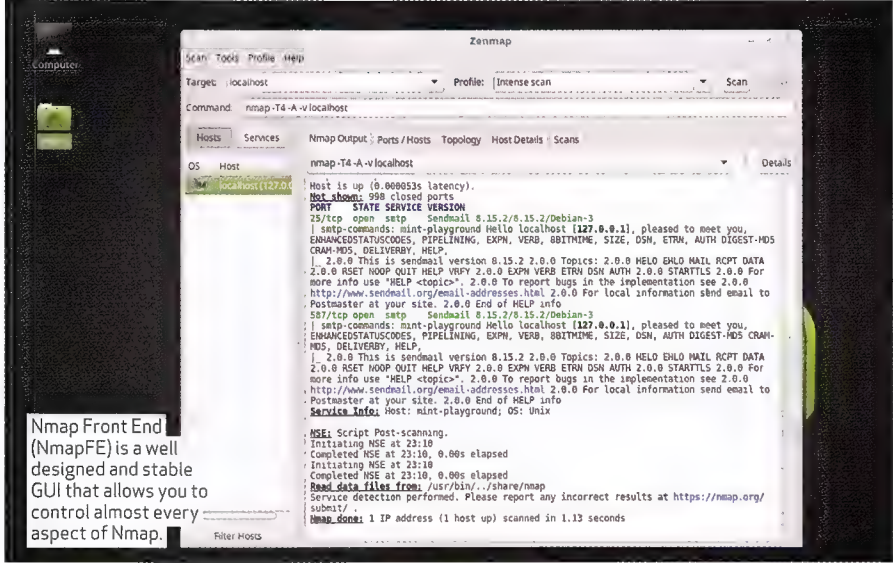
You can also tweak a number of parameters on your kernel to bolster the security. Run `sysctl -a` for a list of current kernel settings. You can save these to a file with: `sysctl -a > ~/sysctl.settings`, which will enable you to use the file for reference or comparisons if you make any changes.

You can change these settings on your running kernel by editing the `/etc/sysctl.conf` file. On Linux Mint, the file already exists and contains a number of these settings, but they are disabled by default.

One of the biggest risks to system security is from untested and unknown applications and you must take precautions to protect your system from such programs. One way to do that is through sandboxing. This involves providing a compartmentalised environment to a script or app, so that the larger part of your installation remains protected.

SANDBOX WITH CHROOT

The oldest sandboxing tool in Linux, chroot can be used to change the root directory for a process. This prevents apps inside a chroot jail from accessing other directories or files. Containers such as Docker can similarly be used



to run isolated application instances. If you're spooked by the prospect of performing too many tasks to feel secure while connecting to the internet, consider using Subgraph OS. Based on Debian, the distro has been designed from the ground up, with a focus on security and privacy. It ships with a hardened Linux kernel, along with out-of-the-box sandboxing for applications, firewall and proxy.

Despite all these tools, you must understand that attaining a completely secure system is an unachievable goal. This is because the process would

require you to, in the words of Linus Torvalds: "Unplug the network cable and instantiate draconian measures for physical security." There's no golden rule for security that applies in every case, and even if there were, it would have been cracked already. Security is something that needs to be worked on and personalised. With the combined weight of all the tools discussed, you'll get the three essential ingredients for good system security – prevention, protection and detection – and that's the best anyone can hope for.

Harden your system

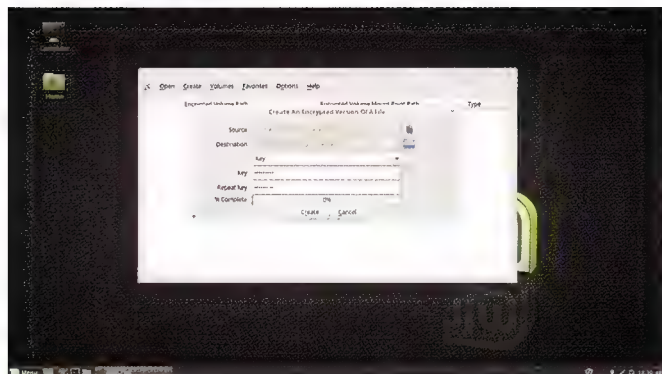
Security hardening involves poorly configured systems, from a security point of view, being identified and made to conform to security standards. This applies to the different layers of a system such as the network, where it'll enable the firewall. On the software level, hardening involves removing packages with known issues, allowing only signed packages to be installed and so on.

Ansible is a popular hardening tool that does all of the above and more. Note, however, that you'll still need to update packages and install security updates manually. To install Ansible and run:

```
pip install ansible
ansible-galaxy install git+https://git.openstack.org/
openstack/ansible-hardening
```

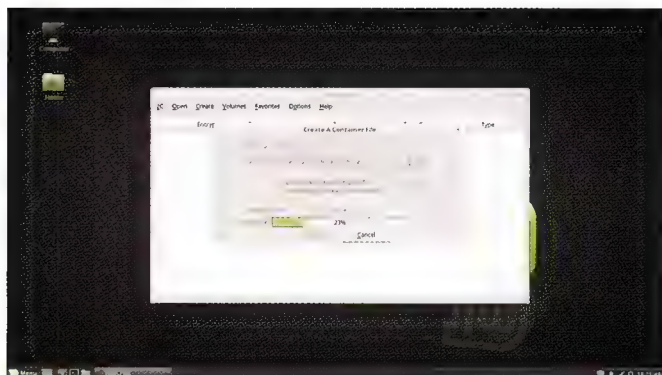


Encrypt files with zuluCrypt



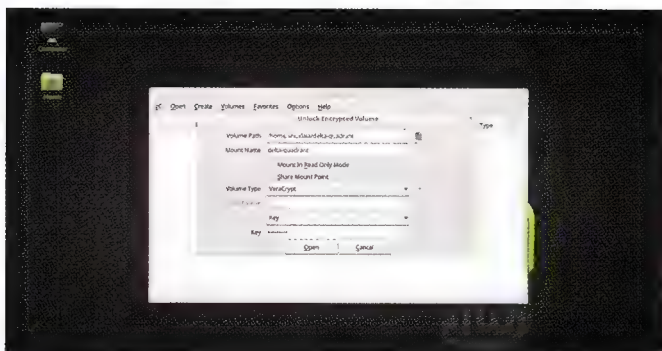
1 ENCRYPT INDIVIDUAL FILES

Head to 'zC > Encrypt A File'. In the dialog box that pops up, click the button adjacent to the Source field and navigate to the file that you wish to encrypt. Then enter a password in the text box labelled Key. zuluCrypt will use this information to create a file with the same name, with the .zc extension at the end. Once a file has been encrypted, make sure you delete its original version.



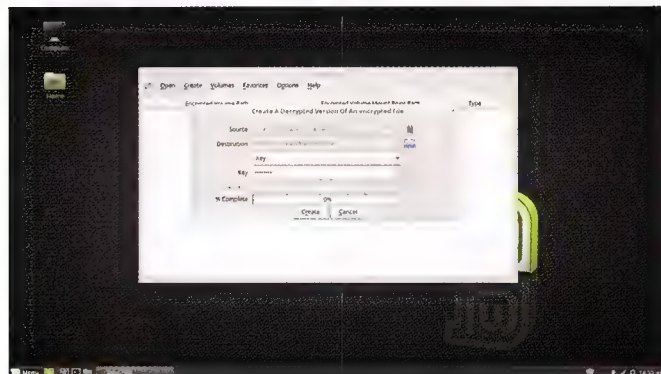
3 CREATE ENCRYPTED SILOS

If you need to protect a number of files that you access frequently, a better approach is to file them inside encrypted storage areas. To create an encrypted storage device within a file, head to 'Create > Encrypted Container In A File'. Then enter the name and complete path of the directory along with its size, depending on the number of files it'll house and the available space on your disk.



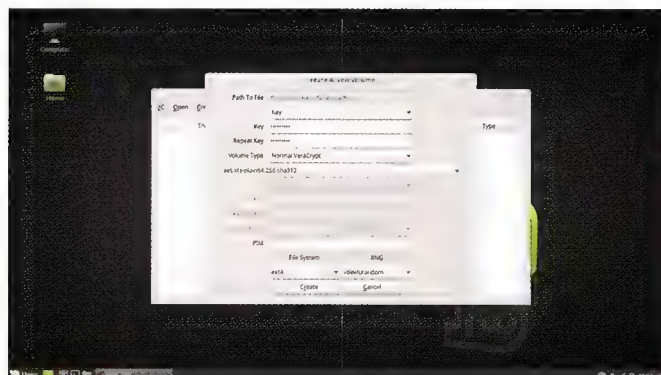
5 MOUNT VOLUME

Before you can store files inside this encrypted volume, you'll first have to decrypt and mount it. Head to 'Open > Volume Hosted In A File'. Use the file button in the pop-up window to navigate to the encrypted container file. You can optionally alter the mount name for the file, else just enter the password and click Open. Once your volume is mounted, it'll appear in your file system like any other mounted file system.



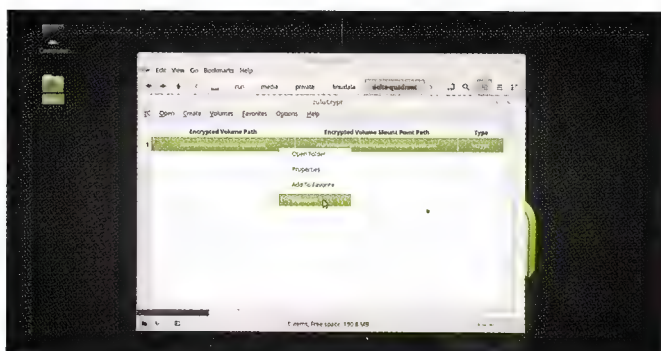
2 DECRYPT THE FILE

Head to 'zC > Decrypt A File'. Point to the encrypted file in the Source field and alter the location of the unlocked file in the Destination field. Now enter the password with which you encrypted the file and click the Create button. When it's done, the decrypted file will be created in the specified destination. To lock the file again, encrypt it by following the outlined procedure outlined in Step 1.



4 VOLUME TYPE

When you click Create, zuluCrypt pops up another window. Besides specifying a password, you'll have to select a Volume Type from the pull-down menu. TrueCrypt or VeraCrypt volumes work best if you want to share the encrypted volume between Linux, Windows and macOS computers. For the other values such as the cipher and file system for the encrypted volume, you can safely stick with the default options.



6 UNMOUNT AFTER USE

You can now create directories within this mounted location and create files, just like you would on any regular mounted device. When you're done, left-click on the mounted volume in the zuluCrypt interface and select Unmount. This will unmount and encrypt the volume and all you'll have once again is the single encrypted file with illegible content. Mount the file again following the procedure in Step 5 to reveal its contents.

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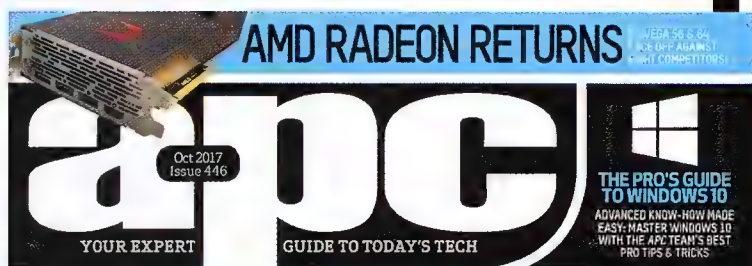
12

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Build a liquid-cooled Ryzen gaming rig

Create an (almost) mid-range build under ice, with Zak Storey.

THE CONCEPT

Well, this was fun. EK Water Blocks sent us one of its latest Fluid Gaming Kits. In fact, it sent us two: a standard 240mm CPU-only loop, and one with an additional GPU block. Naturally, we gravitated to the latter, not because it's pricier than its kin, but because it's the more intriguing solution. We're used to cooling processors off a single 240mm radiator, but adding a GPU to the loop (literally), a part that can pack some serious heat, just seemed ludicrous.

We made the decision to go with Ryzen at the very last minute. We've been wanting to revisit the platform for some time now. As both BIOS and micro-code have developed over the past few months, the platform has gone from being a touch sketchy to a well-equipped all-rounder, filled to the brim with serious computational performance.

Overclocking has always been its limitation, though, with most parts only ever capable of boosting the clock

speed by an additional 200–300MHz. And it's not heat that limits the plucky processor, but silicon, with most, if not all, Ryzen chips being limited to around the 4GHz mark, Threadripper included.

That said, contrary to popular belief, it's not a hot part. Once you strip off the ridiculous +20°C offset AMD imposes on the internal temperature monitoring, it's actually cooler than a lot of Intel's latest Kaby Lake parts. Weird, huh?

DISSECTING THE BEAST

In our continued attempts to annoy our photographers, we decided to go with the shiniest, most reflective case in the world, Corsair's Crystal 570X, with its included RGB fans. It's a dash gaudy, a fingerprint magnet and lacks a lot of the home comforts we expect from a case at this price point. Still, the last laugh was over us, as it's not the friendliest of liquid-cooling chassis. At least, not if you're planning on mounting a reservoir anywhere.

Case aside, the core components are fairly high-end. It's not a cheap build, but not ridiculous either, featuring a GeForce GTX 1070, 32GB of DDR4, and ASUS's king of X370 mobos, the Crosshair VI Hero. And it all went together quite nicely. That G.Skill memory comes packing 16GB per stick at an impressive 3,200MHz, which is apparently the optimum for Ryzen parts, as the infinity fabric connecting all the core complexes runs at the same frequency as the memory, which seems odd, but we'll bite.

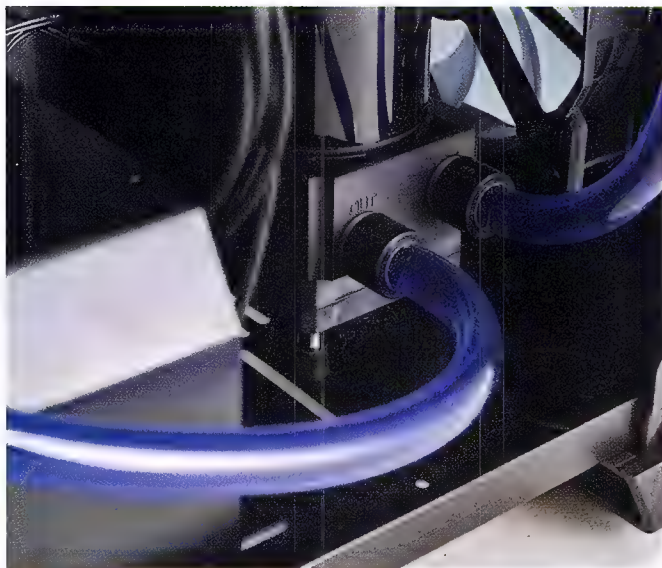
The GPU is the kingpin of this build. The 1070 is a stunning sweet spot of a card. Perfect for 1440p and high refresh 1080p, if you ramp up the power target, and throw a +200MHz clock on the core, it's easy to get an extra 10–15% performance from it.

Unfortunately, ours was a reference card, and is currently unavailable — however, the cheaper GTX 1070s on the market generally use a stock-standard reference PCB, which is fully compatible with EK's latest aluminum waterblock.

PARTS LIST

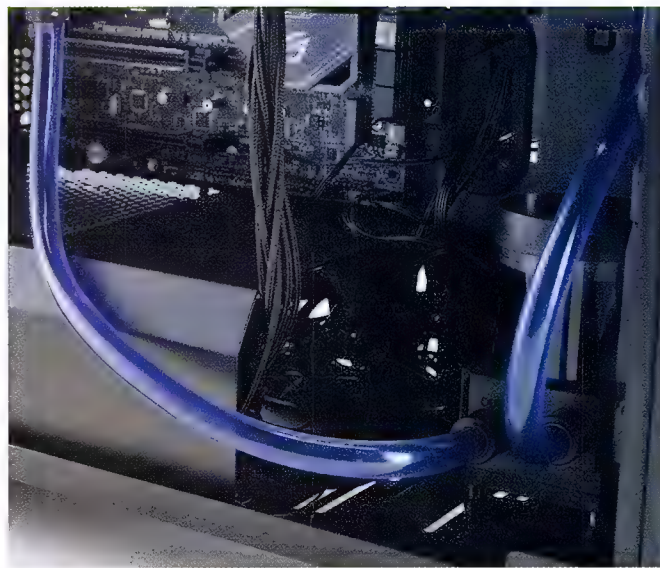
PART		STREET PRICE
CASE	CORSAIR CRYSTAL 570X RGB TG	\$269
MOTHER-BOARD	ASUS ROG CROSSHAIR VI HERO	\$365
CPU	RYZEN 7 1800X	\$669
MEMORY	32GB (2X 16GB) G.SKILL TRIDENTZ SERIES 3,200MT/S	\$555
GPU	EVGA GEFORCE GTX 1070	\$689
PSU	BITFENIX FURY ALCHEMY 750W PLUS GOLD	\$199
STORAGE	275GB CRUCIAL MX300 2.5-INCH SSD	\$145
COOLING	EKWB FLUID GAMING KIT A240G	\$399
OS	WINDOWS 10 HOME	\$179
TOTAL		\$3,469

"Fortunately, Corsair has listened to the complaints of all us pesky jourmos and consumers, and is introducing a variant with a full PSU cover."



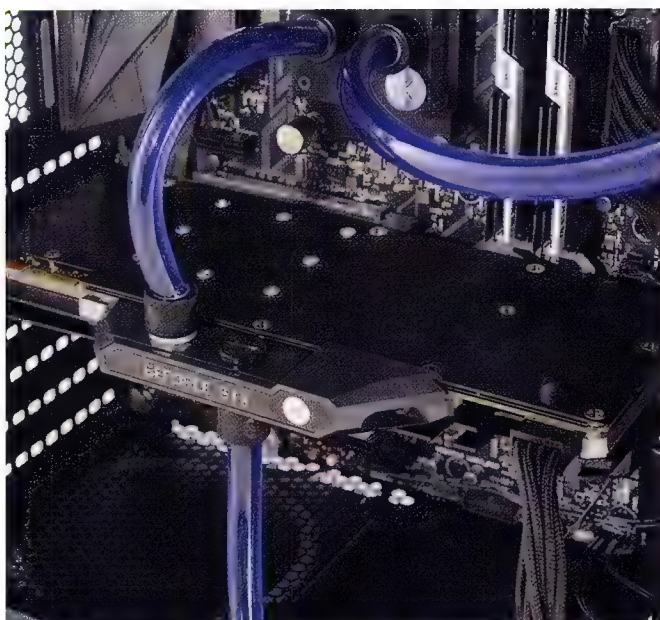
1 MOUNTING MAYHEM

By default, EK's Fluid Gaming Kit includes a bracket that you can install the pump/res on to easily enough — typically, you would run the fans externally of the radiator, then attach it to the internal side of the rad, before then mounting the pump that way. However, we decided to mount ours to the floor. Unfortunately, Corsair's Crystal 570X case lacks any mounting points, so we grabbed the old Dremel, and drilled a couple of mounting points in the floor. To do this, you need to remove the feet from the case, but once in, it's certainly not going anywhere.



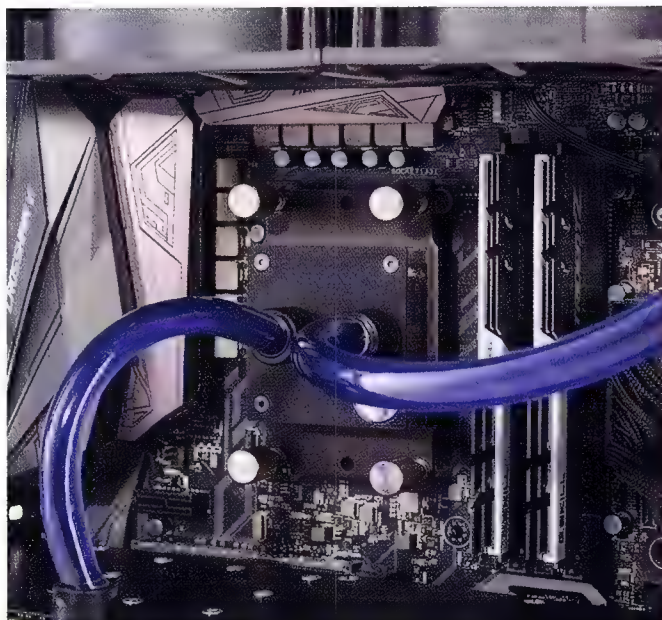
2 ALMOST COVERED

Oh, Corsair... what were you thinking? We absolutely love the Crystal 570X, but the lack of a full PSU cover is genuinely depressing. It wouldn't be so bad if it weren't for the fact that the front (RGB? Yep!) LED logo cable runs haphazardly from the front, hooked under a small metal clip, and into that gaping chasm of a PSU cover. In fact, we're kinda glad the reservoir is there just to hide it. Fortunately, Corsair has listened to the complaints of all us pesky jourmos and consumers, and is introducing a variant with a full PSU cover.



3 ALUMINIUM ARDOUR

There's something about these aluminium blocks we just love. Whether it's the subtle Nvidia font and branding next to the EK logo, or the underside that looks simply stunning, or the fact that EK has somehow managed to bundle in a backplate as well, they're just awesome. Installing the block is a very similar affair to any other GPU block, so once you've nailed this one, you'll be more than capable of installing one on anything from a RX 480 to a Titan Xp. One thing we do wish, though, is that those screws were black, rather than silver — but, hey, you can't always get what you want.



4 A TALE OF TUBES

Soft tubing is simultaneously a joy to work with and a nightmare. Although you don't have to bend it, and it does allow you to swap out components a hell of a lot more easily than its hardline equivalent, attaching it to the barb parts of the fitting is a challenge, particularly with the Fluid Gaming Kits. To make life easier, we recommend getting a bowl of hot water, immersing the end of each length of tubing you've cut to size and want to install on a fitting, then using a pair of needle-nose pliers to stretch the tubing. Then just wiggle it on to the barb.



5 LENGTH MATTERS

EK's Fluid Gaming Kits may be a sweet deal, but the lack of angled fittings can make some of the tubing runs slightly difficult to set up. The problem is, if you run too short a length of tubing, you can get kinks in the tube, cutting off the flow entirely, which is something you absolutely want to avoid. Too long, on the other hand, and it can look unwieldy and messy, and again could develop a kink somewhere. Give yourself a couple of centimetres more tubing than you think you'll need, and slowly cut off segments until you're satisfied that there are no kinks in the run.



6 REAR I/O APLENTY

It wouldn't be 'PC Builder' without a shot of the rear I/O, right? ASUS's Crosshair Hero VI is one of the best specced motherboards out there if you're a peripheral-happy power user, like us. Featuring a staggering 9 x USB 3.1 Type A, 4 x USB 2.0 and, of course, a USB 3.1 Type C, just for good measure, there's a port for everything, and even we can't fill them all up. It's not all USB ports, however — there's a BIOS reset switch, clear CMOS, integrated A/C Wi-Fi, 5.1 audio out and Intel Gigabit Ethernet, too. What's not to love?



1 Here are those CableMod LED strips in action yet again. One single 30cm strip placed along the top of the chassis really helps make the hardware pop.

2 The PSU here is a something of an old office beastie. Running for over two years now, the BitFenix Alchemy 750W is still available today, and comes with black braided cables.

3 If you want to have some overclocking fun with liquid cooling, grab a Ryzen 7 1700 instead of the 1800X, drop the memory to 16GB, and you should see similar performance for a lot less cash.

4 By default, EK provides you with clear coolant in the A240G kit, so we picked up some purple dye, and added a couple of drops to the reservoir loop after it was filled.

Lust for liquid

We had a ton of fun constructing this build – and converting it over to liquid cooling was fairly painless. Plus, watching those GPU temps drop so dramatically was simply joyous. We're still not 100% happy with the whole shebang, but at just \$390 for the loop, we can let EK off. Our tubing runs are a bit too long, and if EK had included a vertical bracket instead of a horizontal one, we'd have mounted the radiator in the front of the chassis, then attached the bracket and the res to it.

Cooling aside, the system runs a treat. That Ryzen 7 1800X certainly doesn't disappoint, smashing through Cinebench with a score of 1,597, and providing some solid single-core performance, too, at 159 – comparable to a stock clocked Skylake Core i5,

which is more than enough for us in any game.

It still has issues in certain older titles; frame stuttering is definitely there, but it's not the end of the world, and as drivers advance with Ryzen in mind for modern titles, it's hardly a big loss. The biggest problem is our sudden envy over eight-core systems. Watching the rendering times of videos fall, and those 16 little squares eat up Cinebench in seconds, made our Core i7-6700K systems seem a little lackluster. Sure, they're great in game, but the lack of computational throughput leaves a sour taste in our mouths.

One thing we haven't really covered is the lack of storage. We'll be honest, the deadlines were particularly tight

for this one, and getting a system set up and ready to go for our cover shoot was a challenge. As always, it had to look good and function almost immediately, so we went with the easy option, and just threw a 275GB Crucial MX300 SSD at it, and that's about it. In the real world, that wouldn't be enough for a system of this calibre. Investing in a 1TB SSD, or even an SSHD, to mount in the back of the chassis, would more than make up for the lack of internal storage. And you could just as easily run a PCIe SSD on the motherboard, and swap out the SSD for something more budget and capacity oriented.

Memory performance intrigued us – latencies have fallen dramatically with Ryzen recently – once upward of 100ns, they've now fallen to 78ns and below. Whether that's down to better BIOS or benchmarking software now registering Ryzen properly is up for debate, but either way, it feels smoother.

So was it worth it? Yes. The cooling is staggering, especially on that GPU, and the performance is solid. Cryptocurrency mining is still butchering GPU prices for now – something that looks unlikely to abate any time soon – but this is still a fairly decent price point for the performance, and it looks killer to boot. ■

BENCHMARK RESULTS

APC LABS TEST PC

CINEBENCH R15 MULTI-THREAD	987	1,597 (62%)
CINEBENCH R15 SINGLE-THREAD	196	159 (-19%)
TECHARP'S X264 HD 5.0.1 (FPS)	21.93	35.36 (61%)
CRYSTALDISK QD32 SEQUENTIAL READ (MB/S)	1,895	532 (-72%)
CRYSTALDISK QD32 SEQUENTIAL WRITE (MB/S)	949	495 (-48%)
RISE OF THE TOMB RAIDER (FPS)	41	57 (39%)
FAR CRY PRIMAL (FPS)	76	78 (3%)
THE DIVISION (FPS)	78	82 (5%)

Our APC Labs test PC uses a Core i7-6700K CPU @ 4.6GHz, an AMD R9 Fury X and 32GB of RAM. All games are tested at 1080p on max settings, with HD texture packages installed.



Turn your Pi into a stop-motion video studio

Build your own animation studio by using your Raspberry Pi as a stop-motion camera.

What have you done with your Raspberry Pi camera lately? While it gives us plenty of new ways to use the Pi, unless you've got your computer set up as a security webcam or you're particularly a fan of time-lapse photography, the chances are that you've overlooked the Pi camera module for a while.

If you're a fan of animation or you simply want to extend the possibilities of the module, why not build a stop-motion camera? By using Python and an external button to capture images, the Raspberry Pi can actually be the perfect tool for animators.

Better still, you can go beyond animating toys or bits of Lego and go old school by mounting the Pi on a rostrum and creating a cartoon. Even if you can't buy or build one, you can mount the stop motion Pi camera with a smartphone mount for stability.

1 MOUNT YOUR STOP-MOTION PI CAMERA

Before you get started, think about the type of animation you're going to be capturing. If you're using the traditional top-down method, as used by classic cartoon animators, then you'll need a rostrum to mount the Raspberry Pi.

Alternatively, you may be animating something on a desk, table or perhaps the floor, but you'll need your Pi camera mounted in a similar way, looking across rather than looking down.

Various options are available, such as smartphone tripods and dashboard mounts. Most of these should be suitable for securely mounting your Raspberry Pi.

2 FIND SOMEWHERE TO SHOOT

For your first attempts at shooting a stop-motion video, you should use a wide and uncluttered space. This might be a desk, a kitchen work surface or

even the floor, but it should be a hard and flat area in most cases (unless you have need for a bumpy carpeted environment for your video) to aid with the creation of your stop-motion film.

As time progresses and your skill develops, other surfaces can prove useful alternatives, but keep it simple for now and stick with flat surfaces while you get to grips with the art form using the Raspberry Pi stop-motion camera.

3 CONNECT THE PI CAMERA MODULE

Next you'll need to connect the Pi camera module to your Raspberry Pi. All models have the necessary connector, although where it is found on the device will depend on the version of your Raspberry Pi.

The Model A has the Pi-camera connector next to the Ethernet port, as does the Model B.

On the B+ and the Raspberry Pi 2, the connector is in a similar position, but it's a little further from the Ethernet port between the audio-out and HDMI ports.

Connecting the camera module can be tricky. Begin with taking your Pi out of its case or remove the top where possible and disconnect all cables. Take precautions before removing the device from its antistatic bag, as the camera module is very sensitive to static electricity.

On the Pi, lift the plastic catch on the connector and slot the camera module flex into place with the shiny contacts facing away from the Ethernet port. Once the flex is fully slotted in, push the plastic catch back into place.

4 TEST YOUR PI CAMERA MODULE

After connecting the Pi camera, check that it works by booting the Raspberry Pi (we're assuming you're running Raspbian) and entering this in the command line:

```
sudo raspi-config
```

With the keyboard arrows, move down to option five, 'Enable Camera', and tap Enter. In the following screen, hit Enter again to enable the camera and exit. If you're not already signed into the GUI, do so now (if you're in the command line interface, enter "startx" to launch the desktop view). Open the terminal and enter:

```
raspistill -o image1.jpg
```

You can review the resulting image in your Home directory.

5 STRAIGHTEN OUT THE IMAGE

With the Pi camera up and running, you may notice that it's outputting the image with the axes flipped. We can fix this using Python, so open the terminal and enter:

```
sudo apt-get install python-  
picamera python3-picamera  
sudo idle3
```

In the Python editor, open 'File > New Window' and enter the code below, setting the 'camera.vflip' and 'camera.hflip' as True or False as required. Save (perhaps as 'camflip.py'), then press F5 to run the script and view the correctly outputted image.

To save time, however, you might try rotating the position of your camera or Pi camera module!

```
import picamera  
from time import sleep  
  
with picamera.PiCamera() as  
camera:
```

```
    camera.vflip = True  
    camera.hflip = True  
    camera.start_preview()  
    sleep(3)  
    camera.capture('/home/pi/  
image2.jpg')  
    camera.stop_preview()
```

6 SET UP THE BREADBOARD AND BUTTON

We have two ways to add a button to the Raspberry Pi, but before proceeding, ensure you have switched the computer off and disconnected it from the mains. You should also disconnect any cables and hardware.

The simplest method of adding a button is to employ a solder-free breadboard and a single-state pushbutton. Connect the button to the breadboard with two male-to-female wires running to GPIO pins GND and 17. With a script designed to detect action from the button on the GPIO, each frame of your animation can be captured with a single button push.

7 CODE FOR STOP MOTION

Once satisfied with the results of your Pi camera, it's time to turn it into a stop-motion camera. The first step is to type up the code shown below, which will capture an image of your subject and save it into a folder called 'Stop motion'. Each image is numbered sequentially and they can all be stitched together once your animation is complete. Save the code as animation.py:

```
import picamera  
from RPi import GPIO  
  
button = 17  
  
GPIO.setmode(GPIO.BCM)  
GPIO.setup(button, GPIO.IN,  
GPIO.PUD_UP)  
  
with picamera.PiCamera() as  
camera:  
    camera.start_preview()  
    frame = 1  
    while True:  
        GPIO.wait_for_  
edge(button, GPIO.FALLING)  
        camera.capture('/home/  
pi/animation/  
frame%03d.  
jpg' % frame)  
        frame += 1  
    camera.stop_preview()
```

Then, in a new terminal window, enter the following:

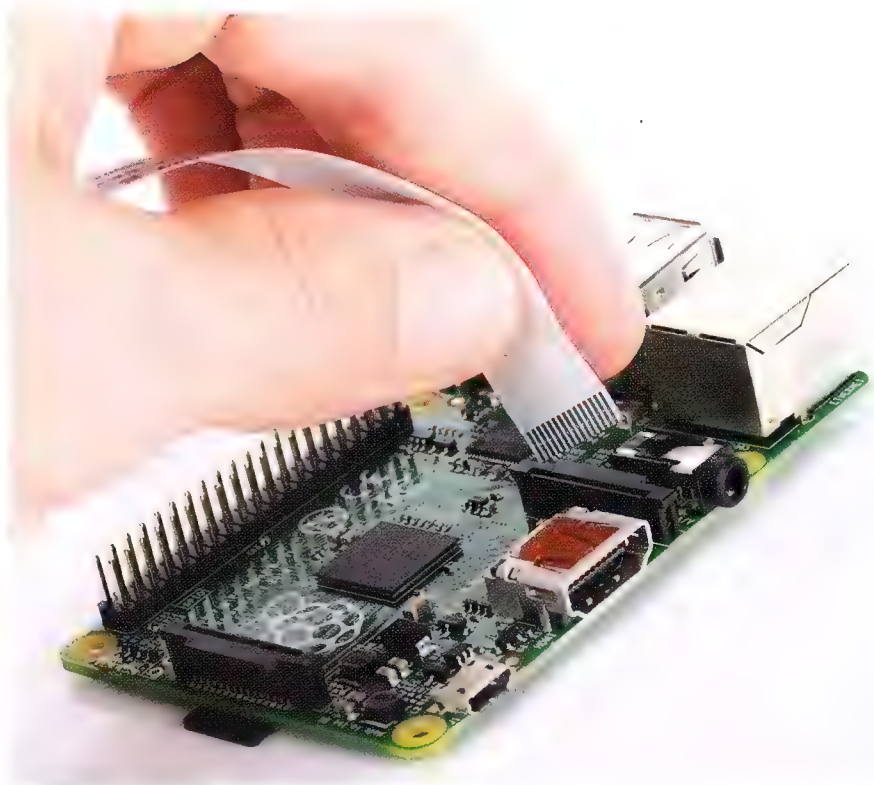
```
sudo python3 animation.py
```

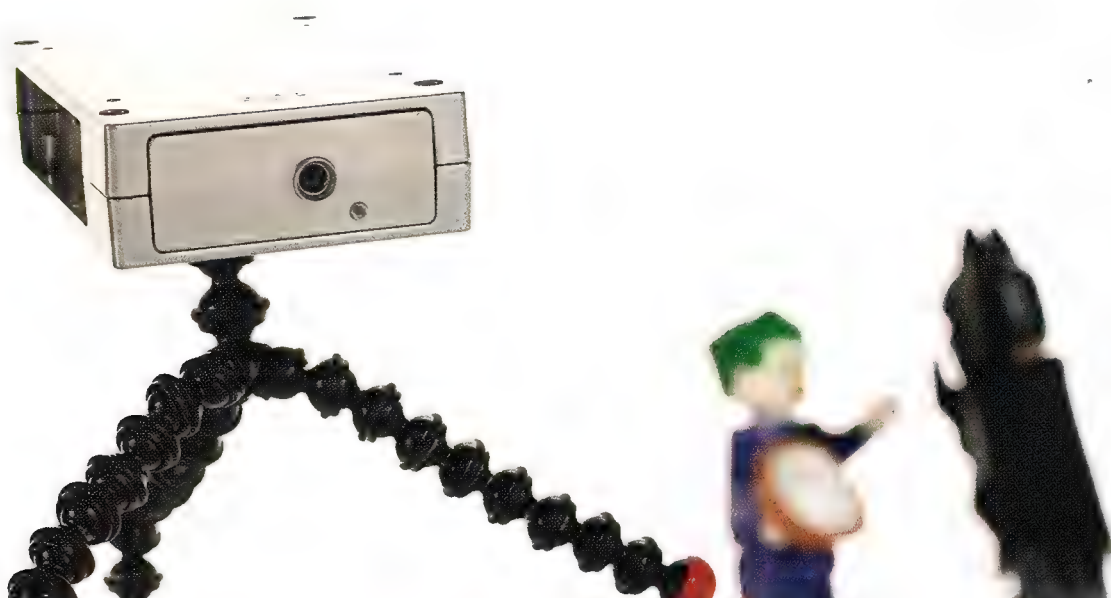
Press the button to capture each frame, moving the subject as needed. When you're all done, hit 'Ctrl-C' to terminate the script.

8 STITCH TOGETHER YOUR STOP-MOTION ANIMATION

For true animation, the collected images will need to be compiled into one single file. In the terminal, install ffmpeg:

```
sudo apt-get install ffmpeg
```





"Don't want to build your own rostrum? Why bother when a camera tripod can be positioned."

Once installed, you will then need to convert your images into a video clip, as follows:

```
ffmpeg -y -f image2 -i /home/pi/Desktop/stop-motion/frame%03d.jpg -r 24 -vcodec libx264 -profile high -preset slow /home/pi/Desktop/stop-motion/animation.mp4
```

With this file created, open with the command:

```
omxplayer animation.mp4
```

The video will then be played in full-screen mode.

9 USE AN APP INSTEAD

Don't fancy using the script? Try this stop-motion application. Begin by installing the raspicam-extras package that includes the UB4L drives for the Pi:

```
wget http://www.linux-projects.org/listing/uv4l_repo/lrkey.asc && sudo apt-key add ./lrkey.asc
sudo sh -c 'echo "deb http://www.linux-projects.org/listing/uv4l_repo/raspbian/wheezy main" >> /etc/apt/sources.list'
sudo apt-get update
sudo apt-get install uv4l
```

```
uv4l-raspicam uv4l-raspicam-extras
```

With that done, enter:

```
sudo apt-get install stopmotion
```

Launch with the stopmotion command to open a GUI with a live camera for you to line up each shot. This is a more elegant solution and captured images can be stitched together using the 'Number of images' slider and the camera button above it.

10 PUT IT ALL TOGETHER

Now you have the camera set up, a device for keeping it steady (whether a DIY rostrum or a tripod), and you've constructed a button or plan to capture each frame via SSH. Your stop-motion Raspberry Pi camera is finally ready!

By now, you're probably aching to get started, so with your stop-motion Pi camera ready to use (and close to a power supply), it's time to start building your film set. While this might simply be an empty table top, there might equally be a few props you would like to include.

11 STORYBOARD YOUR SHOOT

It's easy to get tied up with the idea of creating a stop-motion camera and forget all about a subject and how it will act.

You can avoid any problems here by taking the time to carefully plan what will happen in your film: your story. Remember, each second of the video will require 26 frames!

The best way to plan at this level is to simply write up an outline, but beyond this, you may prefer to storyboard instead by making pencil sketches to help you progress the story.

12 CAST YOUR STOP-MOTION SHOOT

You'll also need a good idea of what your subject will be; this means who or what you're going to be using the stop-motion camera to capture frames of. Typically, amateur stop-motion films make use of household objects, toys and child's play clay.

The beauty of this kind of animation is that you can use almost anything that you can get your hands on, from a cup and saucer to an Action Man, as long as you have a way to support the subject(s) in the positions you wish them to take throughout.

13 STOP-MOTION WITH TOYS

If you cast toys as your stop-motion stars, you will get a much better result from something that is built to stand up on its own than toys that tend to sit or fall over. Lego sets and Minifigs appear in many stop-motion productions on YouTube. This is with good reason, as they're really easy to place in a desired position. The construction element of the bricks is also a major attraction. Another popular option is Transformers toys. These are both good places to start, but you should aim to develop your own approach over time.

14 PEOPLE IN STOP-MOTION FILMS

It isn't only inanimate objects that you can include in stop-motion films. People can feature too! Pop videos such as Peter Gabriel's 1985 hit 'Sledgehammer' have taken advantage of stop motion (that video was produced by Aardman Animations, the eventual creators of *Wallace and Gromit*) and the technique can be used on humans to create surreal effects. If you want your subject to be moving around a room too, they can appear to be floating or gliding. The results can be strange, but useful if you know what you want.

15 MAKE YOUR OWN WALLACE AND GROMIT

Known as 'claymation', the practice of animating lumps of clay has been a popular form of animation for years, but there's more to it than just clay. These forms, whether they're cheese-loving old men, remarkably clever dogs or the wrong pair of trousers, have a wire skeleton that is used to keep movement in the desired position.

This makes it much easier to capture the frames efficiently, but for the best results, you should also have several versions of the same figures available. This is just in case one gets deformed and damaged during production!

16 FROM STOP MOTION TO TIME-LAPSE

Similar to stop motion, time lapse is a technique that automatically captures images on a preset timer. We can use a Python script to control this, saving the captures in a directory and using ffmpeg to compile them into a film.

However, what you may not want for this project is a mains cable trailing all over, especially if you're attempting to capture the movement of the stars at night or nature activity. We suggest employing a Pi-compatible battery pack to make your time-lapse Pi camera truly mobile, using SSH to run the script remotely:

```
import time
import picamera

VIDEO_DAYS = 1
FRAMES_PER_HOUR = 60
FRAMES = FRAMES_PER_HOUR *
24 * VIDEO_
DAYS

def capture_frame(frame):
    with picamera.PiCamera() as
cam:
        time.sleep(2)
        cam.capture('/home/pi/
Desktop/frame%03d.jpg'
% frame)

# Capture the images
for frame in range(FRAMES):
```

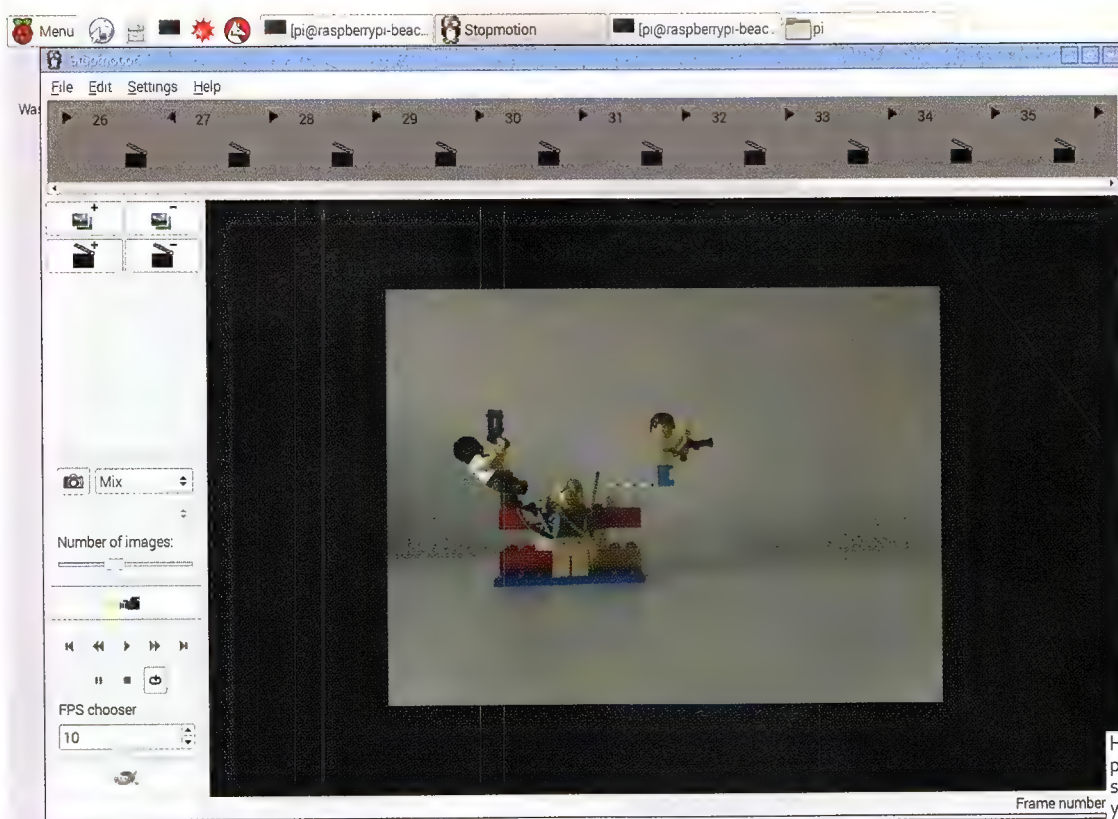
```
# Note the time before the
capture
start = time.time()
capture_frame(frame)

# Wait for the next
capture. Note that we take
into
# account the length of
time it took to capture the
# image when calculating
the delay
time.sleep(
    int(60 * 60 / FRAMES_
PER_HOUR) - (time.time()
v- start)
)
```

17 TAKE YOUR STOP-MOTION STUDIO TO THE NEXT LEVEL

At the risk of encouraging you to become the next Ivor Wood (creator of *The Wombles*, *Paddington* and *Postman Pat*, among others), it is possible to use the Raspberry Pi's camera module for ambitious projects, as well as small ones. After all, this device photographs in high resolution so there is no reason not to adopt this setup and incorporate it into a working stop-motion studio with a miniature set.

Sharing your work through YouTube is a great idea, as well, especially as it will make it simple to add a soundtrack over the top, using YouTube's browser-based editor. ■



Here's the stop motion program in action — it's a simple enough GUI to get your head around and gives you a nice preview window.

Quad-core Android computers for under \$35

The Raspberry Pi has changed the face of DIY computing, but there are Android-ready quad-core single-board computers available, some for under \$35. Darren Yates explains.

If you've been reading us for a while, hopefully, you get the sense we like to do a lot of do-it-yourself here at Masterclass Central, whether it's hacking your Android phone, building your own Arduino projects or learning to code your own Python and Java apps. There's no better way to learn about tech than getting your hands dirty, lifting up the bonnet and seeing what's going on underneath. It's this same philosophy that's embodied in the Raspberry Pi single-board computers.

However, at up to \$75 for a new quad-core Raspberry Pi 3 on your Australian door step, their continued popularity isn't helping bring the local price down. Still, get creative and you'll find a number of alternatives available, some selling for under \$35 – and they'll even run Android.

BATTERY POWERED

The Raspberry Pi 3 is a pretty decent board, offering a quad-core Cortex A53 SoC CPU, 1GB of RAM, built-in Wi-Fi and Bluetooth 4.0 wireless connectivity, HDMI, four USB 2.0 ports and an active user community any product maker would die for. But while there are a number of excellent Linux distros available, fully-working

Android releases to power your Pi are few and far between. You'll find occasional homebrew Marshmallow and Nougat builds; however, at the time of writing, there still wasn't a factory-backed Android distro for the Raspberry Pi. It's a bit surprising, really, given the Pi 3 hardware is right in Android's wheelhouse, being based on ARM Cortex-A53 core technology.

But one of the important things about DIY is making do with what's available – that, and a little creative thinking. That's why, if you head off to your local supermarket or Australia Post store, you're likely to find some pretty useful alternatives with up to quad-core SoC CPUs, built-in screen, 802.11n Wi-Fi and Bluetooth 4.0 connectivity, even built-in battery and Android operating system. OK, yes, I'm talking about budget pre-paid smartphones, but remember, these things are quad-core mobile battery-powered computers first. And they're even better value when you see prices regularly under \$35.

BOOST ZUME 5

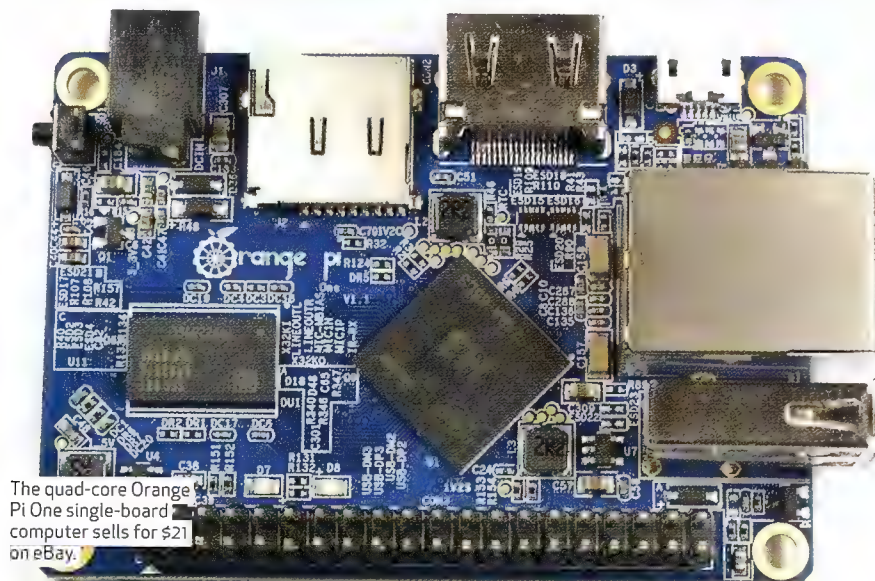
At time of writing, local telco Boost Mobile was pushing its Zume 5, a rebadged ZTE B112 Telstra 4GX-locked phone with Android 6.0/Marshmallow, four-inch screen and 1GHz MediaTek

MT6735P quad-core ARM Cortex-A53 SoC CPU. We found it on special for \$34.50 at Coles and \$39 at Australia Post. For that price, you can hardly expect a phone that's going to trouble a Samsung Galaxy S8 – but for about 3% of the price of an S8, surely that hardly matters. What matters is that you've got a portable battery-powered touch-screen quad-core computer ready to use, built-in OS, storage and all, for quite a bit cheaper than you can buy a Raspberry Pi 3 locally.

When you compare what you get with the Zume 5 against the Raspberry Pi 3, it's pretty decent value. Sure, there are things the Raspberry Pi 3 can do most budget phones can't do, like HDMI video output, for example. But there are things the Zume 5 can do that the Pi 3 can't, like built-in OS and storage, battery power, touchscreen, speaker and microphone, not to mention optional 4G phone connectivity. For \$35, you'll struggle to find anything close to offering the same functionality for the price.

WHAT YOU CAN DO

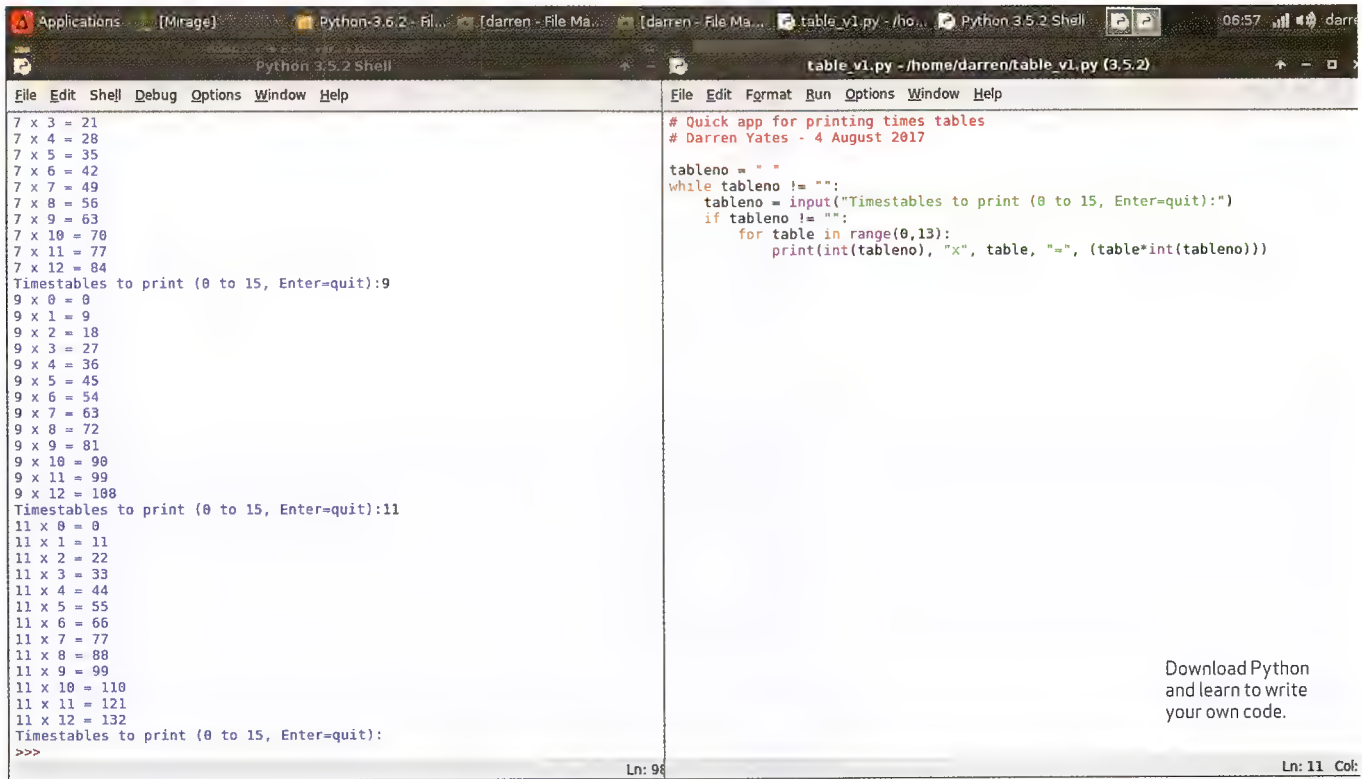
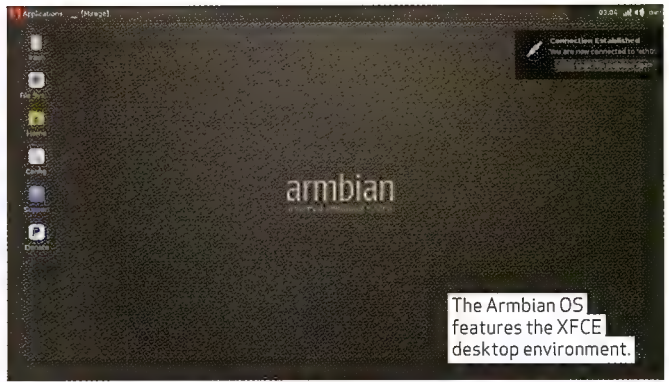
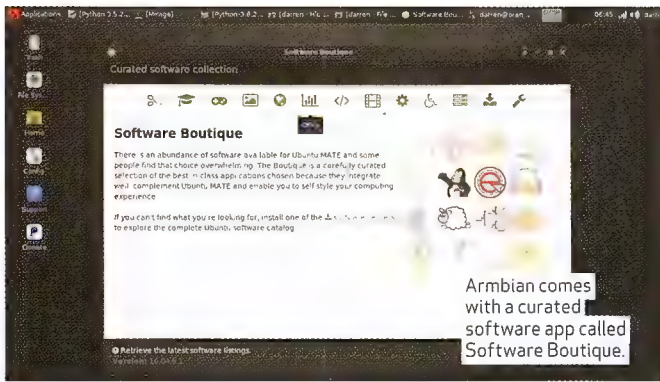
If you're struggling for ideas of what you'd do with a \$35 quad-core battery-



The quad-core Orange Pi One single-board computer sells for \$21 on eBay.



The quad-core Boost Zume 5 phone with Android 6.0 sells for as little as \$35.



Download Python and learn to write your own code.

powered computer — aka pre-paid smartphone — we've got a few already tried and tested:

MAKE YOUR OWN SPEECH-RECOGNITION PROJECTS

In our Learn to Code Masterclass pages this month (see page 106), we show you how to use an Android phone with Wi-Fi and Bluetooth to write Python code and tap into Google's speech-recognition technology. Combine this with the Arduino Masterclass this month (page 104) and you can build your own Bluetooth-enabled LED light you control via your Android phone simply using your voice. The Raspberry Pi gets plenty of kudos for having its General Purpose Input/Output (GPIO) bus, but don't assume just because a smartphone doesn't have an obvious I/O bus that you can't use it to control your own electronic projects.

TAP INTO YOUR CAR'S COMPUTER

We looked at this back in issue 444, but thanks to excellent free apps like

Torque and On-Board Diagnostics-II (OBD-II) Bluetooth dongles for under \$5 on eBay that plug into your car, you can monitor all sorts of real-time data out of your car's engine control unit (ECU), from engine revolutions per minute, to speed, to fuel rates, temperature — dozens of points of real-time data about what your car is up to. Track your driving, analyse the data, improve your skills.

LEARN TO CODE PYTHON

No, that's not a typo — you can learn to code Python on Android. Everyone thinks to code on Android, you need to know Java — that's true to build native apps, but if you read this month's Python Masterclass, you'll learn you can still do some cool things with Python on Android. We're using the free QPython3 app from Google Play, which includes a code editor plus console to run your code. What's really cool about QPython3 is it includes SL4A — Scripting Layer for Android — which allows you to tap into some of the more

exotic features in your Android device, features like text-to-speech, Bluetooth connectivity and speech recognition. And yes, you can do it on a budget \$35 smartphone (we've done it and it works a treat).

CHROMECAST REMOTE

Can't get enough Netflix or Stan? Grab a Chromecast or Chromecast Ultra TV dongle and turn any HDMI-ready TV into the ultimate streaming video-on-demand box. Then grab the Netflix and Stan apps from Google Play and turn a budget phone into a simple low-cost Chromecast remote control. When you consider the price of some universal remotes, \$35 for a touchscreen remote is pretty damn good value.

CAN'T FIND THE ZUME S?

Realistically, budget pre-paid phones come and go with regular monotony these days. The ZTE B112 is similar to the Alcatel Pixi 3 (4.5)/TCL 5017A that we looked at last year, which had

how » android masterclass

the same SoC, same price, but older Lollipop/Android 5.0 operating system. If you can't find a ZTE B112, it's highly likely there'll be something very similar in its place.

Of course, if you've got an old Android phone sitting in the drawer, this is the perfect opportunity to give it a second life. QPython3 works on devices with Android 4.0.3 or later, although we've found Google Speech Recognition works a little better on devices with 4.3/Jelly Bean or later. Either way, couple QPython3 with on-board Bluetooth and Wi-Fi and you've got the tools to code simple speech recognition apps. The benefit of buying new is the more recent version of Android.

ORANGE PI ONE

For something more like a genuine Raspberry Pi, there are plenty of options available. Some of those options are the Orange Pi family of single-board computers (SBCs) made by Chinese maker Shenzhen Xunlong (www.orangepi.org) and one of their

cheapest boards is the Orange Pi One. This credit card-sized board features a GPIO header pin-compatible with the Raspberry Pi Model B+, full-size HDMI output, two USB ports (one OTG), even RJ45 Ethernet port. It's powered by Allwinner's H3 SoC, a 1.2GHz quad-core ARM Cortex-A7 SoC, with 512MB of RAM and microSD card slot for storage. Best of all, you'll find it on eBay for just \$21, or about a third of the price of a Raspberry Pi 3.

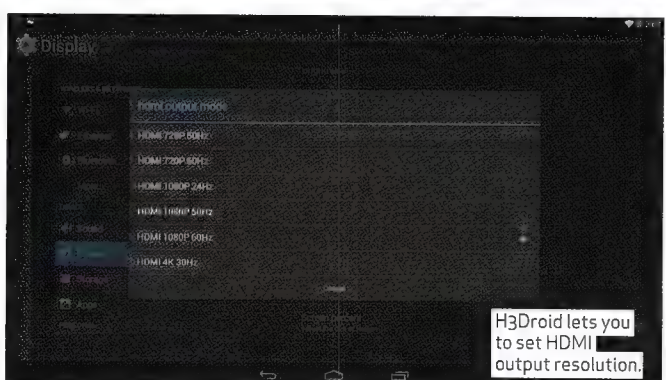
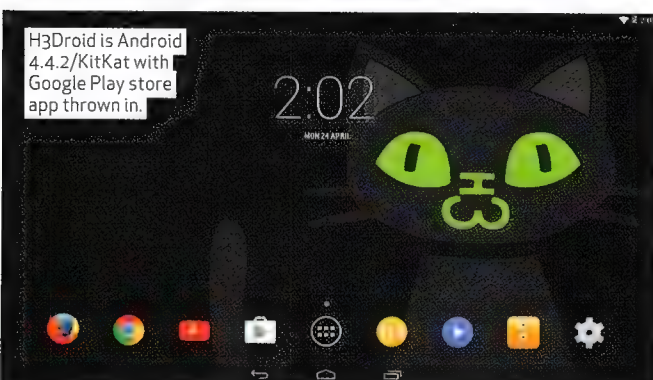
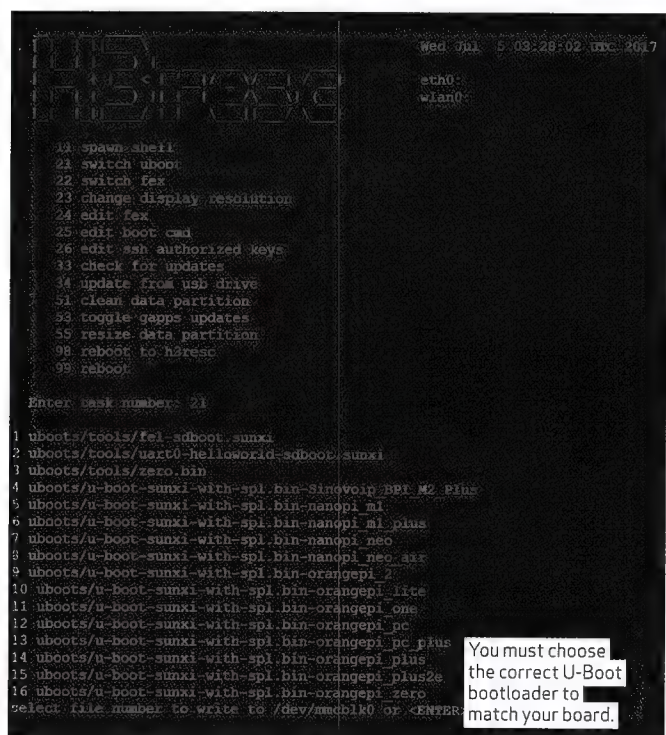
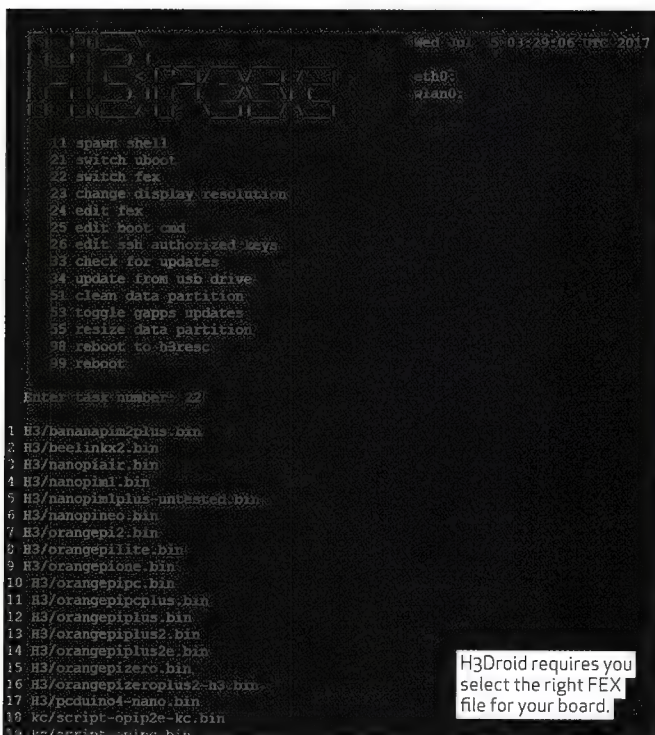
In fact, it's almost an exceptional little single-board computer – almost. The Orange Pi One uses a more-limited CPU voltage regulator with a reduced CPU voltage range, the end result being it gets a bit warm – to be safe, I put a small self-stick heatsink on mine over the CPU. You'll find these on eBay, designed for Raspberry Pi boards, for about \$1. And while we're on the subject of power, you must power the board via the DC socket, not the USB-OTG microUSB port. Use the microUSB port and the sky falls in. Well, it probably doesn't – but don't do it. Use a good 5VDC/2A USB power

adapter with a USB-to-4.0x1.7mm DC plug cable instead.

The Orange Pi team have a number of OS releases available, mostly Linux distros, with the occasional Android offering – unfortunately, none of which we could get working. That's not a problem, though, for there's an excellent third-party Linux distro, a Debian Xenial-based release called Armbian (www.armbian.com). It features my favourite XFCE desktop environment and access to the full Debian ARMv7 software repository for a genuine Linux desktop setup. From our experience, it's a great little OS – it's fast, automatically found our D-Link DWA-125 Wi-Fi dongle, it'll even play 1080p (Full HD) MPEG-4 video, no sweat. Love it.

H3DROID

But if you'd prefer something more Android-flavoured, the new H3Droid is worth a look. This is third-party Android 4.4.2/KitKat release is designed to run on SBCs powered by the Allwinner H3 SoC, including the



Orange Pi One. We've tested it and it's actually pretty decent. H3Droid is essentially not much more than an Android Open-Source Program (AOSP) build with the Google Play store thrown in, but that's enough to get you everything else.

As for performance, the Allwinner H3 won't blow you away for speed, but for a 1.2GHz quad-core ARM Cortex-A7 SoC, it's similar to a few entry-level tablets available at the moment. But it's another reason why we recommend a Class-10 microSD card — most retailers should have a 16GB Sandisk Ultra Class-10 card for under \$15.

INSTALLING H3DROID

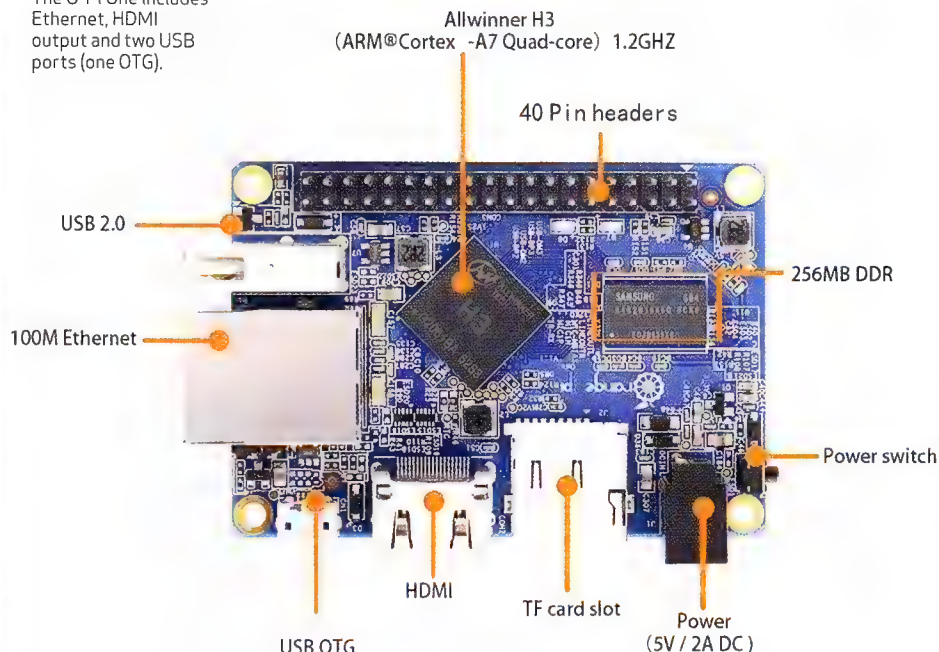
H3Droid runs off the MicroSD card and the H3Droid team has done its homework, creating a simple setup system you can perform on any Windows computer. First, you download the latest H3Droid Image Installer (H3ii) image from h3droid.com/download. Unzip it with 7-Zip (7-zip.org/download.html) and write the image to a MicroSD card with Win32DiskImager (tinyurl.com/odxlnmf). Then you install the card into the Orange Pi One and boot.

But here's the clever bit — H3Droid automatically launches a boot script to convert the file format to 'ext4' and rewrites Android onto the card. The Android image itself is only 171MB to download and 260MB written to the card. We used a 4GB card, and even after the full install, we still had just over 2GB of space left for apps.

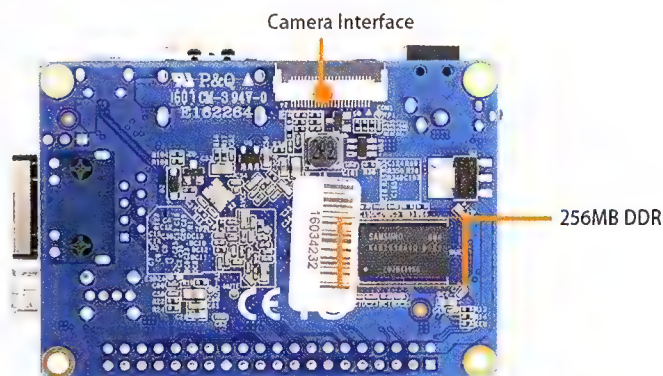
However, once that initial boot process is complete, it boots into Recovery Mode where you must perform two important additional steps. The first step is to set the correct U-boot bootloader for the Allwinner board you're using. In our example with the Orange Pi One, you first enter '21' to move into the 'switch U-Boot' menu list, then choose '11' for the Orange Pi One U-Boot bootloader. The second step is set the correct FEX file (choose '9' for the Orange Pi One). An FEX file is basically a descriptor file telling Android how the board works, everything from which GPIO pin is which, through to USB devices, HDMI, the works. Select the wrong FEX option and everything goes pear-shaped. That said, once that's done, you now just reboot (select option '99'). Android will boot up straight to the home screen, not the usual Android setup process, so to be safe, we logged in using a test Google account we have for these occasions.

Like any Android device, the first boot will take some time, but after that, things should be fairly streamlined — even more so if you use a fast-class MicroSD card.

The O-Pi One includes Ethernet, HDMI output and two USB ports (one OTG).



Bottom view



H3DROID PERFORMANCE

You can set the HDMI output resolution and frequency, but the one thing to be aware of is the higher you set the resolution, the harder the SoC has to work, the hotter it'll get and the slower it'll run. Personally, for Allwinner H3 boards and H3Droid, I'll be sticking with 720p (1,280 x 720 pixels) to maximise performance.

While it shows great potential, H3Droid is, realistically, still a work in progress — in our experience, there were good bits and some not so good bits. We had USB Wi-Fi dongles working on boot (D-Link's 802.11n DWA-125 and 802.11g DWL-G122), but Bluetooth didn't work. YouTube was generally fine, just a little stutter at first, while MX Player delivered 720p (1,280 x 720-pixel) HD video with hardware decoding,

easy. However, for some reason, we had trouble with 1080p playback happening with software decoding only (with noticeable frame skipping). Gmail worked a treat, but *Angry Birds* took ages to load (we didn't bother waiting).

All that said, H3Droid is still the best Android release for Orange Pi boards we've seen so far, so we'll keep an eye on it over coming months.

THINK OUTSIDE THE BOX

There's an old saying that if all you have is a hammer, everything looks like a nail. The Raspberry Pi is a great learning tool, no question, but if that's all you know, it can make it more difficult to see other solutions you may already have. And those solutions could be as close as your local supermarket — or hiding in your desk drawer. ■

Building the voice-controlled wireless LED light

Darren Yates continues his combined Python/Arduino/Android project, building the hardware using a Bluetooth transceiver and tiny Arduino Nano microcontroller.

This month, we're combining Arduino, Python and Android to create a wireless light switch controlled by combining Bluetooth, your Android smartphone and your voice. Your Android phone provides the speech recognition and wireless control, Python provides the code to activate the speech recognition and Bluetooth communication, but here, we detail the Arduino hardware, including the Bluetooth module and LED light.

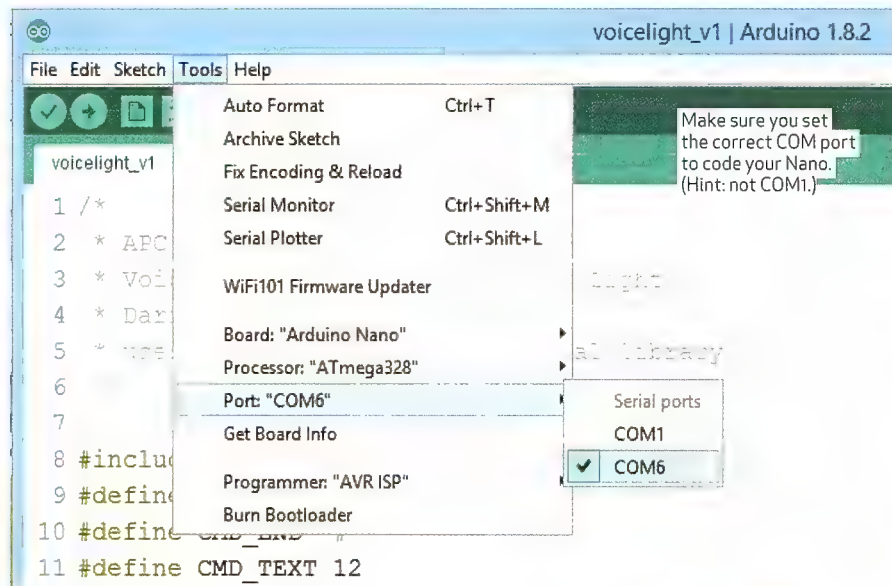
HC-06 BLUETOOTH

The Arduino Nano microcontroller board we've based this project on doesn't have wireless connectivity built in, so we pull in the compact four-pin HC-06 Bluetooth module. It's easy to code and just like working with a serial connection.

There's one condition, however – it's designed to run on anything from 3.6V to 6VDC, but can only deal in signal levels of 3.3VDC. The signal it sends to the Arduino ('TXD') is fine but it must receive a 3.3VDC signal in return. Since the Arduino Nano only deals in 5VDC increments, we need to implement a simple voltage divider to drop the voltage down. There's a simple equation for working out voltage division with just two resistors:

$$V_{out} = V_{in} \times R2 / (R1 + R2)$$

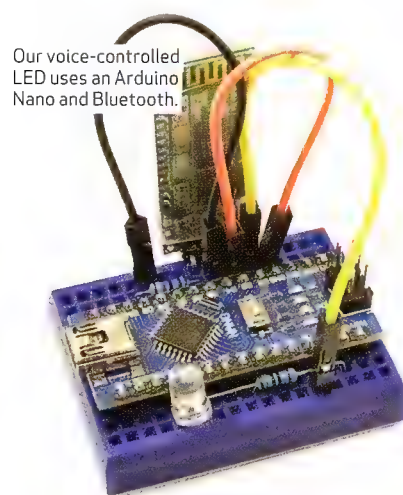
Here, we're using a 10kohm resistor for R1, a 20kohm resistor for R2 and V_{in} (the input voltage) is 5VDC. Punch



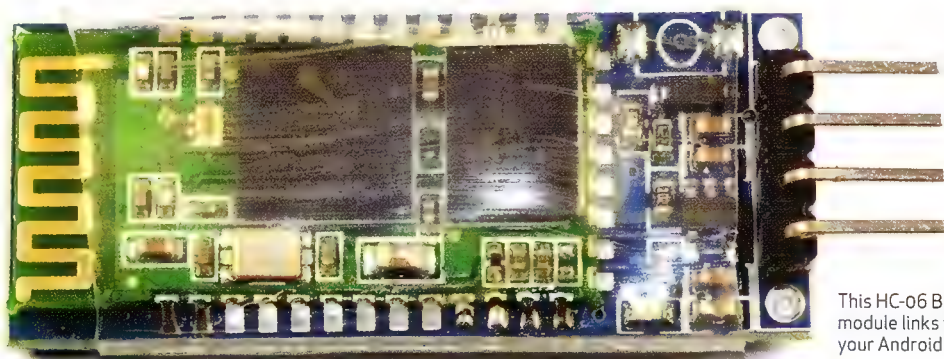
those into the equation and you get 3.33VDC. If you don't have a 20kohm resistor, you can substitute an 18kohm resistor instead – this will give 3.21VDC, which will be fine. Most digital inputs have a tolerance of +/-10% before things start to wobble and we're well inside that.

SOFTWARE SERIAL

The other issue we have with the Arduino Nano is that it only has one serial channel – the RX and TX ports on pins D0 and D1. If we use these to communicate with the HC-06, we lose our ability to communicate with the PC over the Serial Monitor, which uses the



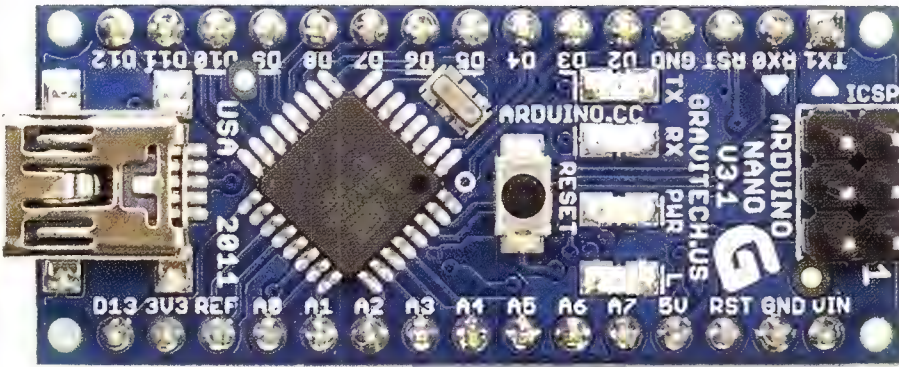
Our voice-controlled LED uses an Arduino Nano and Bluetooth.



This HC-06 Bluetooth module links with your Android phone.



The Arduino Nano is a tiny 8-bit microcontroller for making your own gear.



same serial channel. The solution is to create a second serial channel, which we do in software, using the excellent AltSoftSerial library. This turns pins D4 and D5 into a pseudo-serial channel, which work just fine for our purposes.

For the most part, the HC-06 does its own thing – it waits for a pairing request from the Android phone and further waits for a connection request from our Python code on the Android phone (that's when the HC-06 comms LED stops flashing). Meanwhile, our Arduino code is on continuous loop, asking the HC-06 module 'Any text message yet?' When one finally appears, our code grabs the text, searches for the words 'on' and 'off' and sets the voltage level on pin A0 appropriately, turning the LED on or off as required.

LED OUTPUT

We've used a low-cost high-brightness white LED as our 'light' for this project,

connected to one of the analog input pins, A0, which we reprogram as a digital output. Arduino boards with the ATMEGA328P microcontroller chip can source (provide) or sink (accept) up to 40mA of current on I/O pins and to ensure we don't blow up the Nano or the LED, we need to limit the current flowing through that LED. LEDs have what's known as a 'forward voltage' (Vf), which is the minimum nominal voltage required across the LED pins before any current will flow and any light appears. For white LEDs, it's roughly 3.5VDC – we say 'roughly' because it's not exactly precise as it varies with different LED makes.

To limit the current flow, we need a current-limiting resistor in series with the LED and again, there's another equation we use to be scientific about it and ensure we get the right value of resistor:

$$R_c = (V_{in} - V_f) / I_f$$

Here, 'Rc' is the current-limiting resistor in ohms, 'Vin' is the 5VDC output from the A0 pin, 'Vf' is the nominal 3.5VDC forward voltage drop across the LED and 'If' is the 10mA current flow we want through the LED. Again, dump those numbers into the equation and you get $R_c = (5 - 3.5) / 0.01 = 150\text{ohms}$. The important thing to realise here is that these numbers have a lot of leeway built in – all standard 5mm LEDs are able to handle at least 20mA of current, but by aiming for only 10mA, we're building a safety margin in case the forward voltage drop of the LED, Vf, isn't as high as 3.5VDC. If it's lower, we'll get more current flowing through the LED, but it won't cause issues until we get more than 20mA of current flow. And for that to happen, Vf will need to drop by half to 1.7V – and that's not going to happen with a white LED, so the 150ohm value works nicely.

BUILDING THE LIGHT

Everything fits on a tiny 170-tiepoint breadboard, with all parts purchased from eBay. Power is supplied through the miniUSB port, either via PC USB port or USB power adapter. Follow the overlay diagram and you shouldn't have too many issues.

CODING THE SOFTWARE

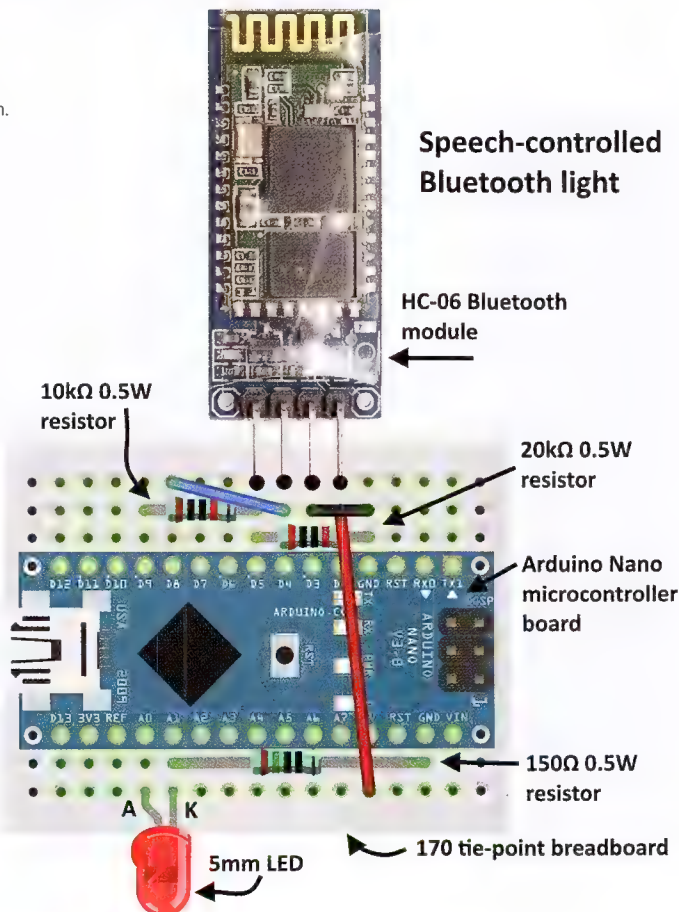
You'll find the Arduino software required for this project on the APC website at apcmag.com/magstuff. Download the zip file, unzip it and copy the contents of the /libraries subfolder into the same of your Arduino IDE. Don't have the Arduino IDE? Get it from arduino.cc/downloads. Plug in the Arduino Nano into your PC, launch the IDE, open the voicelight.ino file, make sure you select the Arduino Nano board and the correct COM port in the 'Tools' menu – don't select COM1, that's mouse. Flash the code to your Arduino, plug it into the breadboard and power up. If all is well, the comms LED on the Bluetooth module will start flashing.

From here, follow this month's Python Masterclass for getting your Android phone up and running to communicate via Bluetooth and speech recognition.

MAKING THE INTERNET OF THINGS

Market analysts forecast the Internet of Things will exceed 20 billion devices by 2020. Making your own IoT devices is the best way I know of to learn how this stuff works and what it can be used for. Remember, this project might only turn on and off an LED, but the same technique with more powerful electronics can turn on and off almost anything you like. Once you've got the basics, it only takes your imagination to create your own brilliant ideas. ■

Use this overlay diagram to build your own version.



Code Android Bluetooth and speech-recognition in Python

Darren Yates explores Python on Android to create a speech-controlled light using Arduino hardware, beginning with coding your Bluetooth-ready phone or tablet.

Artificial Intelligence or 'AI' is pretty big business at the moment. You have the tech giants promoting their speech-recognition standalone assistants, particularly the new Google Home, not to mention Amazon's Echo, Apple's soon-to-arrive HomePod and a raft of other alternatives we're yet to see in Australia. Typically, you can ask these devices questions, get them to turn on and off network-connected lights – think of yourself as Tony Stark communicating with JARVIS to create a 'smart' home.

But if you have a late-model Android phone or tablet, about \$15 worth of eBay-sourced electronics (which we cover in this month's Arduino Masterclass, page 104) and some Python code, you can create your own speech-controlled wireless LED light, courtesy of Google's existing speech-recognition tech inside Android.

WHAT YOU NEED

This project comes in two main parts – the Python code we'll look at here that you run on your Android smartphone or tablet acting as your remote control, plus the Arduino-powered LED light project that you can read about elsewhere in this issue. But when these two come together, your voice becomes your light switch – OK, that sounds a bit try-hard, but it's still pretty cool.

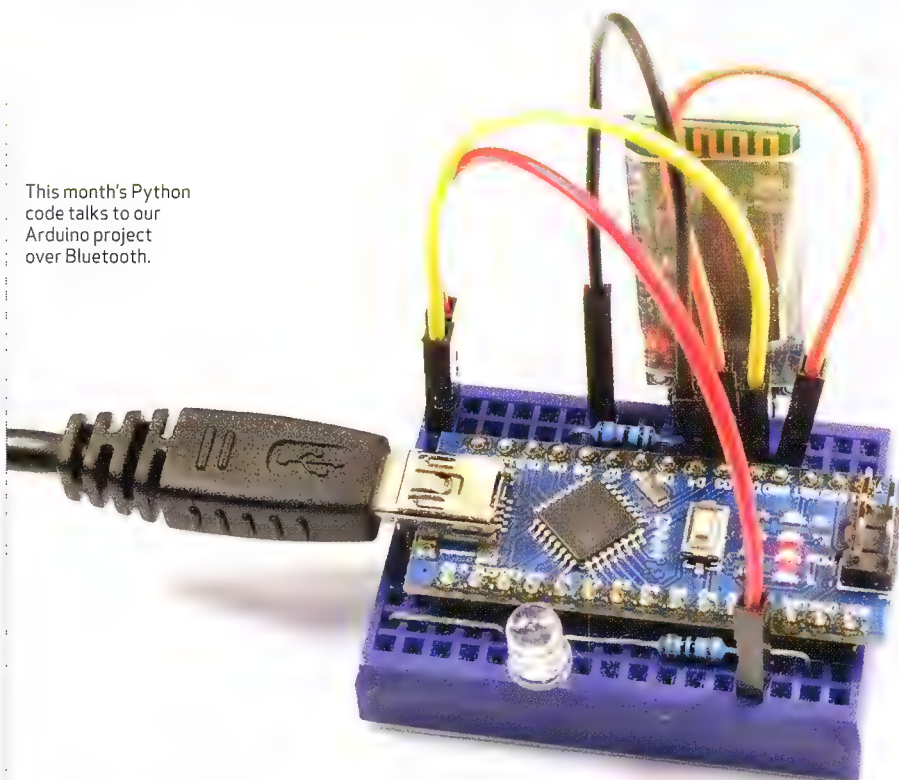
So to begin, you'll need an Android device with at least Android 4.4 (KitKat), working built-in Bluetooth, a decent built-in microphone and either Wi-Fi or mobile network data plan (we'll explain why as we go).

For software, you'll need QPython3 (tinyurl.com/y94pyp6p) and Bluetooth Finder (tinyurl.com/nrufr4w), both free apps available on Google Play, along with our 'voicelight.py' source code available from the APC website (apcmag.com/magstuff).

PYTHON ON ANDROID

We looked at QPython3 last month, a nicely-done Python 3 integrated development environment (IDE) for Android. What makes it worth

This month's Python code talks to our Arduino project over Bluetooth.



```

8 state = 0
9 droid = s14a.Android()
10 droid.toggleBluetoothState(True)
11
12 # change this to your HC-06 MAC address
13 mac_address = "04:12:00:12:34:56"
14 # change this to your HC-06 MAC address
15
16 retVal = droid.bluetoothConnect("00001101-00
17
18 while not ("stop" in answer):
19     answer = droid.recognizeSpeech().result
20     if "on" in answer:
21         if state == 0:
22             droid.bluetoothWrite("**12on#")
23             droid.ttsSpeak("the lights are n
24             state = 1
25         else:
26             droid.ttsSpeak("the lights shoul
27     elif "off" in answer:
28         if state == 1:
29             droid.bluetoothWrite("**12off#")
30             droid.ttsSpeak("the lights shoul
31             state = 0
32         else:
33             droid.ttsSpeak("the lights shoul
34     elif "stop" in answer:
35         droid.ttsSpeak("bluetooth link stoppe
36         droid.bluetoothStop()
37     else:
38         droid.ttsSpeak("please repeat comman
39         time.sleep(3)
40

```

Python code for our Bluetooth LED light coded on a Motorola Moto G5.

```

/data/user/0/org.qpython.qpy3/files/bin/qpy
thon-android5.sh "/storage/emulated/0/qpyth
on/scripts3/.last_tmp.py" && exit
/qpython/scripts3/.last_tmp.py" && exit <
#[QPython] Press enter to exit

```

After saying 'stop', the code acknowledges and drops back to the console.

the download is its ability to not only run Python code on your Android device, but also tap into exotic Android features such as text-to-speech (TTS), speech recognition and Bluetooth wireless connectivity.

We've tested QPython3 on a range of Android releases from 4.0.3 through to 7.0 and it works really well. The only place you might strike trouble is getting it to run on x86 hardware – we tried it on the latest Android-x86 7.1 RC1 release with no success.

SCRIPTING LAYER FOR ANDROID

This added ability to tap into Android goodies comes from a programming layer inside QPython3 called 'Scripting Layer for Android' or 'SL4A'. Originally developed by Google, SL4A has been added to QPython3. SL4A's original goal was to allow scripting languages like Python and Ruby to use Android features without needing to fight your way around the Java programming language to make them work. It potentially makes using these features easy, although, as we found, not everything works exactly as expected. That said, our project uses three key Android features via SL4A – speech recognition, text-to-speech (TTS) and Bluetooth.

To use SL4A in Python, you begin by just importing the SL4A library into your code and creating an 'Android' object using the commands:

```
import sl4a
droid = sl4a.Android()
```

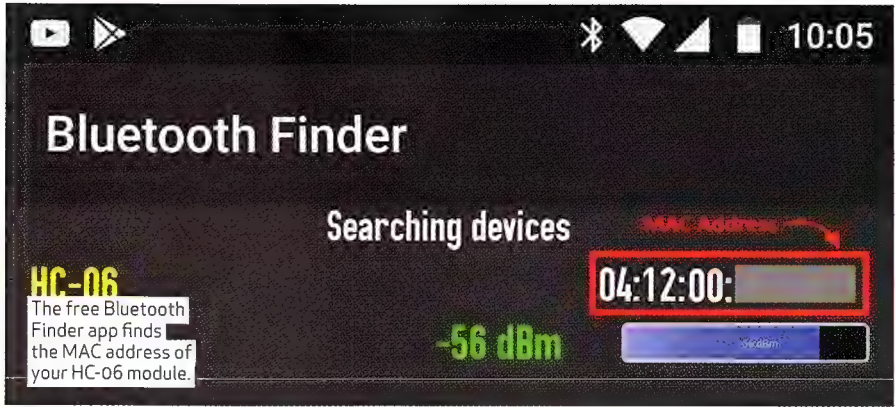
The first line imports the sl4a code library, the second creates an SL4A Android object called 'droid'.

ANDROID SPEECH RECOGNIZER

Speech recognition has been baked into Android for a long time now – ever since Android 2.2/Froyo. The functionality itself is available to Java developers through an Android class called 'SpeechRecognizer'. Thankfully, you don't need to know anything about how it works, other than one brilliantly simple SL4A command:

```
answer = droid.
recognizeSpeech().result
```

This one line initiates the Android speech recognition function by launching the phone dialog interface, records your speech and returns the speech as plain text to the 'answer' variable. If SpeechRecognizer doesn't hear you saying anything, it'll even pause and notify you to tap the screen when you're ready to voice your command. For one line of code, that's about as easy as speech recognition gets.



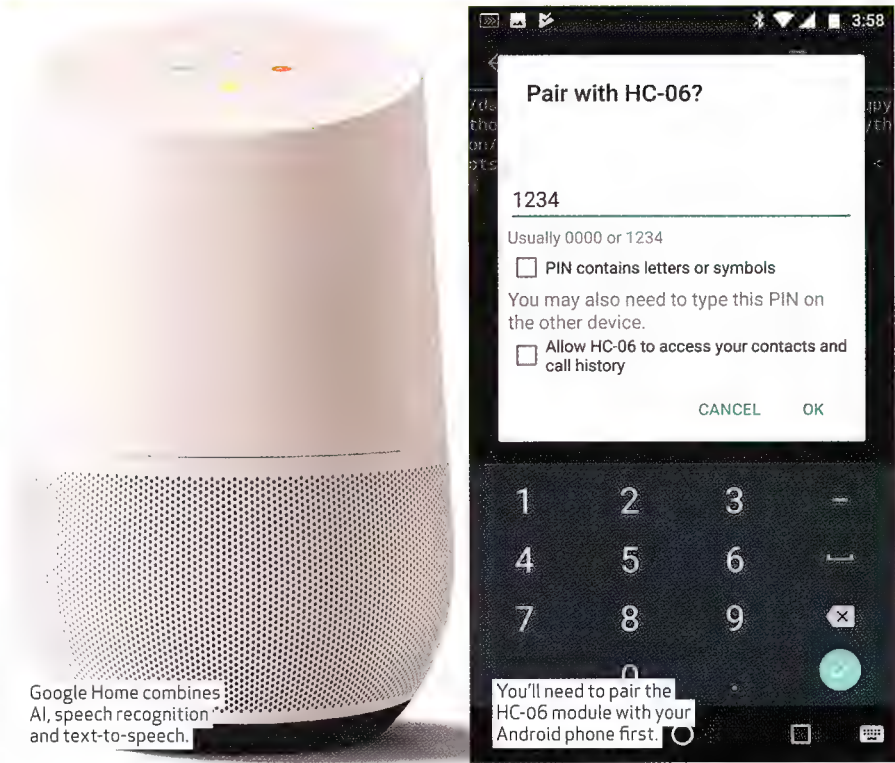
However, in the background, there's even more going on – once the SpeechRecognizer class has captured your speech, it must send that audio back to Google to turn into plain text. Once that's done, the plain text is returned back to your Android device. We've tested this with Wi-Fi and mobile network data and it works either way. Without this internet connection, though, this form of speech recognition just doesn't work. Phones don't have the necessary RAM to handle the algorithms required for detecting

speech and the language libraries, so sending the recorded speech to Google is a necessity.

TEXT-TO-SPEECH

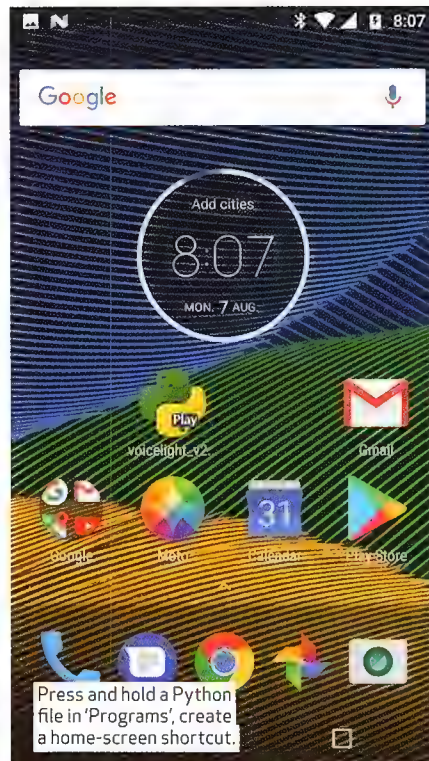
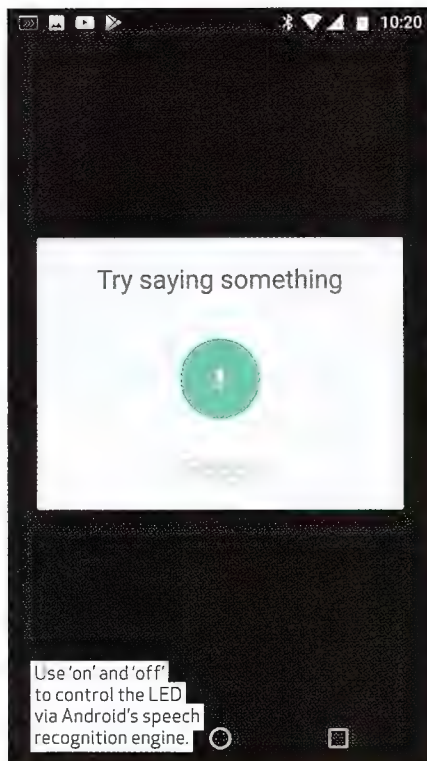
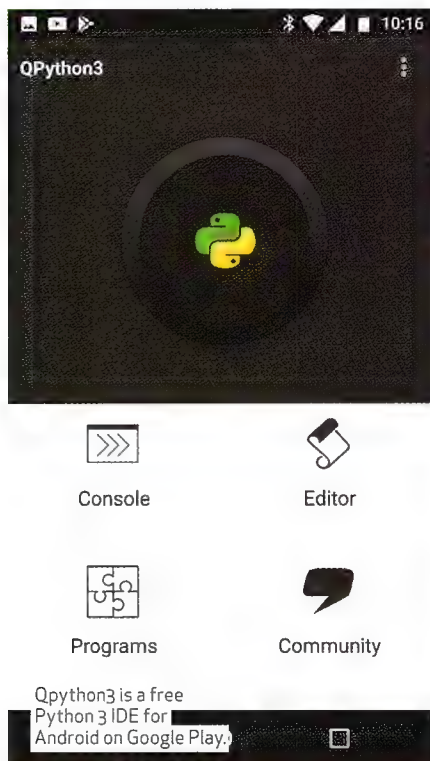
But if you're going to have speech recognition in your app, you can't not have text-to-speech going back the other way. Android has supported TTS since the very beginning (well, at least since Donut/1.6), but in more recent Android releases, it's received plenty of love from Google with improvements such as variation in expressiveness

"Phones don't have the necessary RAM to handle the algorithms required for detecting speech and the language libraries, so sending the recorded speech to Google is a necessity."



Google Home combines AI, speech recognition and text-to-speech.

You'll need to pair the HC-06 module with your Android phone first.



and a greater variety of voices — even an Australian voice.

As we mentioned earlier, TTS comes to our Python code through SL4A and again, it's about as simple to use as you can get:

```
droid.ttsSpeak("hello, my
name is python")
```

TTS is initiated by calling the 'ttsSpeak()' function as part of the 'droid' object and the only parameter you need to add is the text string you want your device to say. Simple. The one thing we've found is that you don't quite get enough of a delay from a comma during TTS, so for a more dramatic pause, try a full-stop (period) instead. You also don't have to worry about capitalising your text — if you don't say it normally, the TTS engine won't. Spelling, however, is important — TTS will say exactly what's in your string, but if it doesn't recognise the word, you may get some unexpected results.

BLUETOOTH

The real key to this project is being able to tap into your Android device's Bluetooth transceiver. Now the various online SL4A reference guides suggest you should be able to code the command:

```
returnValue = droid.
bluetoothConnect()
```

Do this and Android should ask you to select from the paired Bluetooth devices you already have available.

"The real key to this project is being able to tap into your Android device's Bluetooth transceiver."

The problem is it didn't do that for us. In fact, it didn't do anything. The only way we could make this work is to use the more-complex command:

```
retVal = droid.
bluetoothConnect("00001101
-0000-1000-8000-00805F9B34FB
","04:12:00:14:00:53")
```

The first string of characters looks like nonsense but it's actually a 128-bit universally unique identifier (UUID) for serial port profile (SPP) service used by Bluetooth modules like the HC-06 in our Arduino project. In other words, think of it as a universal phone number for dialling up Bluetooth serial connectivity functions. The second string is the 48-bit media access control (MAC) address of the HC-06 module as it's paired to your Android device. The first string is always the same, however, the second string has to match the HC-06's MAC address and it's not always easy to find.

That's where Bluetooth Finder on Google Play ([tinyurl.com/nrufr4w](https://play.google.com/store/apps/details?id=com.nrufr4w)) fits the bill. This free app locates nearby Bluetooth devices, gives you their signal strength and, importantly for us, their MAC address. Grab that MAC address for the HC-06 Bluetooth module and type it into the

'mac_address' variable in the voicelight.py source code.

There's one other thing this command does and that's to wait or 'block' further code execution until either you get a connection success or fail condition. With a successful connection, your code can now continue with a connected Bluetooth module.

CONNECTING VS PAIRING

In terms of coding, it's important to remember that connecting is not the same as pairing — just because a Bluetooth device is paired with your Android phone doesn't mean it has an active connection ready to go. To throw in a fairly dodgy analogy, pairing is like giving your phone number to your mate — that alone doesn't give you a phone connection. Your mate still has to dial the number and you accept the call before you can have a conversation.

What's even more impressive about the bluetoothConnect() command is that if your Android device isn't first paired with the Bluetooth module before that command is executed, it'll automatically bring up the pairing/password window and have you fill in the password (typically '0000' or '1234' in this case) before continuing —

kudos to the developers who figured that all out.

GETTING AND USING THE CODE

You'll find the Python source code for this project on the APC website (apcmag.com/magstuff). Unzip it, copy the 'voicelight.py' file to your phone and into the '/qpython/scripts3' subfolder. Make sure your Arduino project is powered up and the HC-06 module's red LED is flashing away. Pair your phone with the HC-06 module, then launch QPython3 on your phone, select 'Programs' from the main screen and load 'voicelight.py' from the list. On the little pop-up window, select 'open', change the 'mac_address' string variable to match the MAC address of your HC-06 Bluetooth module you recorded from Bluetooth Finder.

Once you've done that, save (press the disk icon) and press the triangle 'run' icon at the bottom of the screen and the code should launch. Once a connection is made, the HC-06's LED should stay lit. Press the back arrow on your phone at any time to end the code.

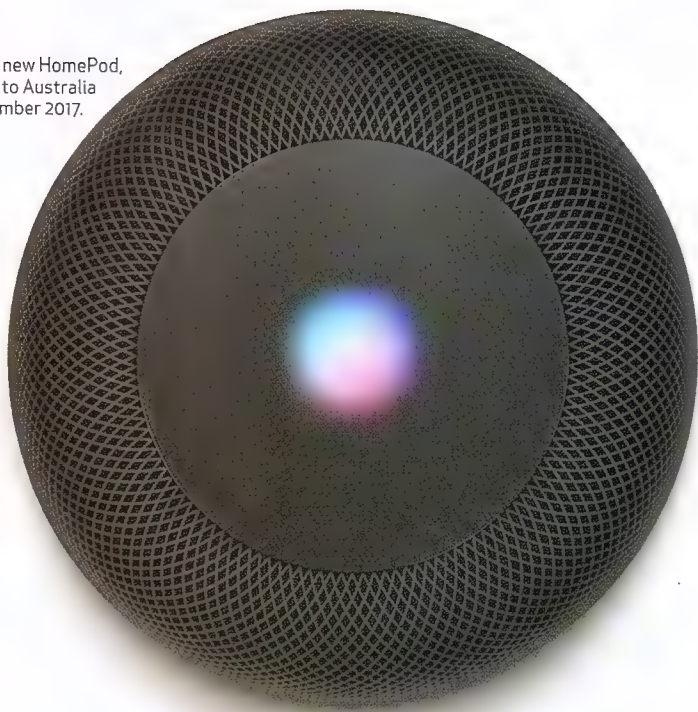
THROWING YOUR VOICE

As soon as everything is set, you'll get the Google speech recognition dialog user interface appear on your Android device. We'll assume you've read this month's Arduino Masterclass, built the Bluetooth LED light project and have it up and running — otherwise, nothing much else will happen.

Now you're ready for your big moment — speak the command into your phone to turn the LED light on or off. The way we've designed the Python code is that it doesn't matter really what you say into your phone at this point — it's just looking for two keywords: 'on' and 'off'. If you say either one in your speech, the code picks up on this and then sends the appropriate command wirelessly to the HC-06 Bluetooth module in the Arduino project. So you could try being cute and say: "Jarvis, turn the lights on, thanks, mate!" and show off to your friends, or you could go for word-economy and just say: "On!" and get the same result. You could even code in your own secret keywords — 'apple' for 'on' and 'cats' for 'off' — whatever, that's up to you.

The key thing is that Google sends back the plain text of whatever you said and it's stored in the 'answer' variable in our Python code. We then use the 'in' string search function to look for the keywords and execute the appropriate action from there. Once that's been done, we loop around again over the while-loop, waiting for the next audible input. If that input is 'stop', the code will disengage the Bluetooth connection and give you audible cue to that effect.

Apple's new HomePod, coming to Australia in December 2017.



DATA CHARGES AND LIMITATIONS

The one thing to be aware of is that speech recognition requires the Android 'SpeechRecognizer' class and according to Android documentation, "The implementation of this API is likely to stream audio to remote servers to perform speech recognition. As such this API is not intended to be used for continuous recognition, which would consume a significant amount of battery and bandwidth." (tinyurl.com/zpn78bn). So we've got two implications here — first, the more you say, the more it will cost you in bandwidth, and if using your phone network data plan, watch that usage carefully. But second, the service is in some way time-limited. Google doesn't say how it's limited; however, some users have reported a 60-second time-limit exists for each speech 'session'. After that time, the speech recognition dialog interface closes.

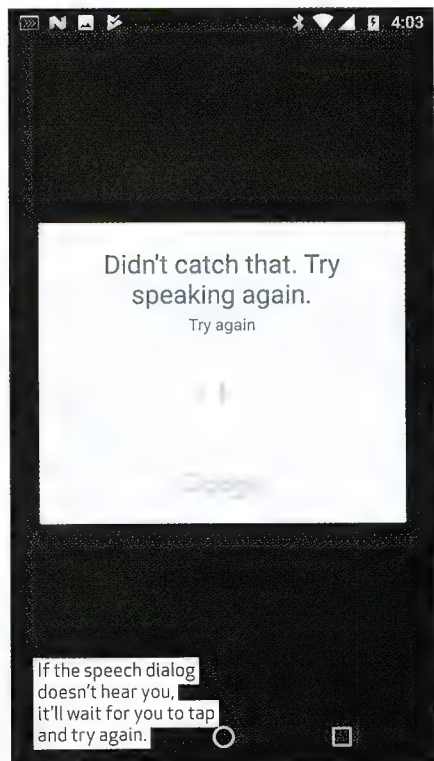
One thing we've observed in practice is that, if the speech interface doesn't hear any speech, it'll revert to the 'tap and speak' dialog and just wait until you're ready, which is handy as it provides its own code-blocking, rather than you having to code it.

CREATING SHORTCUTS

A cool little extra is the ability to create shortcuts for your Python code. While you're in the 'scripts' window of the QPython3 app, press and hold one of the Python script files and the 'create shortcut' dialog box should appear, allowing you to create an app launcher icon for your apps list. Drag the shortcut to your home screen and now you can run your Python app code without having to pre-launch QPython3.

YOUR IMAGINATION

Turning on an LED by voice using Bluetooth might not float everyone's boat, but once you have the mechanism for switching digital I/O wirelessly by voice, you can use it to switch on or off just about anything with the right electronics and a good dose of imagination. Python wasn't designed to create standalone Android apps, but it's still a fun way to learn coding and learn just how versatile the Python language can be. ■



downtimegames

» EDITED BY ARMEL SEALEY

apc
HOT PRODUCT

From here, there's no turning back for Senua.

"Expect the voices to mock you about how you don't know where you're going — an ingenious way to subtly put you back on the right path without holding your hand."

PS4, PC | \$44.95 | WWW.HELLBLADE.COM

Hellblade: Senua's Sacrifice

A one-way ticket to Helheim.

Opting to go the indie route for its latest release, British developer Ninja Theory has applied the same triple-A production values that brought it great acclaim in titles like *Heavenly Sword* and *DmC* to a more intimate, yet no less ambitious affair.

A psychological horror game at its core, *Hellblade* follows a Pict named Senua as she takes an unnerving journey into a Celtic and Norse mythology-inspired underworld where she must battle psychotic manifestations caused by her severe mental illness. Needless to say, this is far from light entertainment. With only the abusive voices in her head to keep her company, Senua sets off on a lonely quest to bring her deceased lover back to life. The game recommends you play with headphones — a terrific suggestion that greatly improves the overall

experience. Those voices in Senua's head? Now they're the voices in your head, constantly insulting and laughing at you, telling you how worthless you are and doubting you at every turn.

At first, these taunts are disheartening, but then, something clicks and it becomes apparent that these jibes can be used to your advantage. Walking off in the wrong direction? Expect the voices to mock you about how you don't know where you're going —

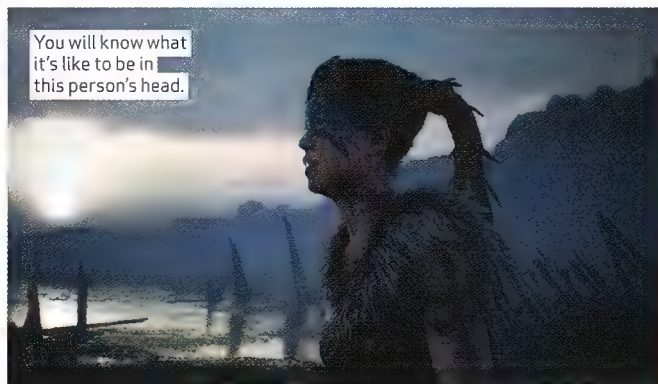
an ingenious way to subtly put you back on the right path without holding your hand. You may get some help from time to time, but don't let that fool you — this is a relentlessly grim game with the lurking threat of perma-death constantly looming over you if you fail too many times.

In terms of gameplay, *Hellblade* consists mostly of puzzle-solving and melee combat with some light exploration. A lot of the time, you'll be trying to

solve perspective puzzles or finding hidden glyphs in the surrounding environment in order to unlock closed-off barriers. You do this by using your focus ability, which allows you to look closely at symbols, activate totems and even slow down the action during combat scenarios. Combat isn't particularly deep, but it still manages to be quite satisfying in its simplicity.

However, the quality of Ninja Theory's storytelling has never been better. *Hellblade* aims to show you what it's like to suffer from mental illness, and does a better job than any other game in recent memory.

■ Stephen Lambrechts



Verdict

A hellish odyssey that will blow you away with its cinematic presentation and nightmarish atmosphere.





✓✓✓
apc
RECOMMENDS

PC, PS4, XO | \$22.95 | WWW.BLACKTHEFALL.COM

Black the Fall

You say you want a revolution? Jump to it...

Black The Fall is an intelligent and, at times, brilliant side-scrolling platform-puzzler that will prompt comparisons with Playdead's *Inside*. But Sand Sailor Studio's debut has enough character to say something new about dark futures informed by dark pasts.

It begins with a room full of people pedalling stationary bicycles, forever. In a dim and noisy warehouse, somewhere deep in the belly of a USSR-esque regime, bike wheels whirr, powering the machinery that oppresses their riders. The nameless protagonist has pedalled his last, though. He's breaking out of this world, right under the noses of the pot-bellied guards and surveillance cameras surrounding him.

By puzzling, you understand. Many shots are fired in *Black The Fall*, but they're directed at you, rather than by you. For the opening hour, you're introduced to the visual language and the rules: being spotted by anything means being shot dead on sight, missing a jump means

a swift demise, and anything orange is vital to interact with. What works best about these puzzles is that they're often contrived so that you're working yourself free while in extreme, agonising proximity to your captors. Sometimes to your fellow downtrodden denizens, too. Better still are the moments of revelation that dawn when the camera perspective unexpectedly shifts, or the world's colour palette suddenly expands. It conveys a lot without uttering a word.

Then a less revelatory thing happens: the puzzles get harder, but not more inventive. The signposting gets subtler, and as it does, the oddness of *Black The Fall*'s 2.5D perspective becomes problematic. Sometimes, we got stuck because the Escher-esque landscapes distorted relative distances between objects, obscuring the solution. Sometimes, the imprecise movement and jumping controls let us down. Towards the game's climax, when the cadence becomes a treacle-slow trudge from one 15-minute

headscratcher to the next, we longed for earlier moments of invention like having to navigate using only sound, and the tension-relieving, puzzle-free sequences in which we only had to run, jump and admire the scenery for a bit.

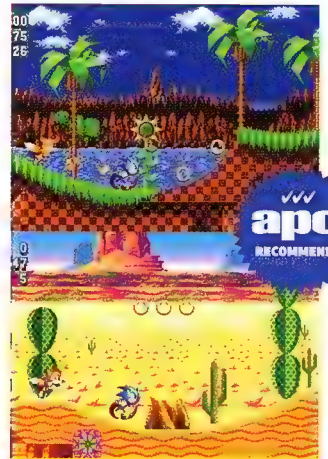
On balance, that later difficulty doesn't sour the experience, and the solutions are never so obscure that they aren't signposted at least a little bit. What does take the edge off *Black The Fall*'s obvious qualities is that, as the puzzles get harder, the thematic cohesion that worked so well in the beginning – puzzles that made sense in the game world and told the story – reaches its limit.

Latter-half slog aside, it's an affecting and, at times, inspired debut from Sand Sailor Studio.

■ Phil Iwaniuk

Verdict

While the level design did trip us up a bit at times, the overall experience is definitely worth it.



✓✓✓
apc
RECOMMENDS

Sonic Mania

The holy trinity – Sonic, Tails and Knuckles – are back in the blue hedgehog's best in 20 years.

PC, PS4, XO, SWITCH
FROM \$26.95
WWW.SEGA.COM

One look at those screenshots and you'll think you've gone back to 1994. *Sonic Mania* is a firm return to the halcyon days when a new *Sonic The Hedgehog* game was guaranteed to be fast, fun and all about platforming. It's almost as if the last 20-something years of torturous 3D games with Big The Cat and fishing never happened.

This really is the best bits of *Sonic 3* and *Sonic 2*, the games you remember, but remade and remixed. The only concession to modern tech (depending on your hardware) is that it runs in 1080p, 60 frames per second, and Sonic and chums have more frames of animation giving them more sticking power on those giddy loop-the-loops. Levels are a hit-list of favourites, from the fast and rolling Green Hills Zone to the more technical Flying Battery with a few new locations thrown in between. Remarkably, *Sonic Mania* manages to appeal to anyone feeling nostalgic, and anyone who's only ever seen the blue blur's titles in the bargain bin. ■ Paul Taylor





Pyre

A spark of genius that lights an impressive fire.

PC, PS4 | \$29.95
SUPERGIANTGAMES.COM

Told in a visual novel style, *Pyre* sucks us in from the start with your character on the brink of death. The writing is sharp, regularly employing a wry humour. The deep history of the world is revealed slowly and in pieces, a dangerous game for a writer to play. We're pleased to report that the tactic pays off handsomely. The surreal fantasy atmosphere is expertly supported by a gorgeous and varied soundtrack. In terms of gameplay, there are 3v3 battles, which mix ARPG presentation with sports game elements. Each side has a pyre that they need to protect. An orb with the power to weaken a pyre is dropped into the middle of the arena. The two teams then vie for control of the orb, so that they can either fling it into the opposing pyre or jump into it while holding the orb, which respawns each time a side 'scores'. This continues until one pyre is extinguished. Between battles, you'll make choices as you go. Early on, any effects of any decision you make will almost always be short-term only, but when you finally make it to the end, your decisions become more impactful. Outside of the campaign, there's a Versus mode, where you can concentrate on the Rites, which is best appreciated after finishing the story. The lack of online functionality is a shame, but understandable.

■ Luke Kemp



PC | US\$10 | WWW.RUPECK.COM/CAVEBLAZERS

Caveblazers

Does this procedural platformer steal *Spelunky's* crown?

Caveblazers is a sidescrolling roguelike with random loot and perma-death. As you delve down further into a cave full of riches, you'll encounter powerful enemies and find new gear to kill them with. You'll find gold, and spend it on items and health refills from shrines. You'll find blessings — buffs that can tweak and enhance your build. And you'll die, in many painful, cheap and amusing, ways — often as a result of your own hubris.

A *Spelunky* comparison is inevitable. I don't think *Caveblazers* is as good as *Spelunky* — few games are — but it finds success in how it builds on the simplistic perfection of Mossmouth's dungeon diver. For instance, here, you have two weapons: one melee, one ranged. This changes how you approach combat encounters and the abilities of the monsters you face. Many can close distance quickly, forcing you to make a split-second decision. Do you stand your ground and battle, or try to increase the gap — giving you the space to pick them off at range? Randomised

weapons and upgrades factors in — maybe you'll end up with an amazing bow, but an underpowered sword, or a powerful axe paired with a hand cannon that's useful in specific situations. The loot defines your build, and changes your strategy each time.

Caveblazers is quick to punish mistakes, and also desperation. You'll find potions but, in classic roguelike style, they're unidentified. Maybe they'll restore health or increase your melee or ranged damage stats, or decrease those stats (or worse). Health restoration items are a big deal, and rare, and the price of filling your health bar at shrines becomes increasingly prohibitive as you move deeper into the dungeon. You can befriend AI dungeon delvers to help soak up some of the damage, but they can also be a liability. Everything is a risk down in the dark.

On our 12th run, we made a dumb mistake with some Jumpers — difficult, highly mobile monsters that explode on contact. We limped towards the first boss encounter and, seeing that it was the flying cube,

decided to try our luck with a potion. We combusted — unceremoniously burning to death only two levels in.

The bosses are our least favourite part of this game, largely because of the repetition. As a challenge, they're fine — there are bosses we can kill without taking a hit, but who'll still punish a lapse in concentration. But unlike in regular play, these encounters mostly remain the same, no matter the build. A better bow may make things quicker, but that only affects the length of the fight, not how we approach it. Despite this misstep, though, *Caveblazers* is an excellent procedural platformer. It's slightly looser and less intricate than *Spelunky*, but it scratches the same itch — offering plenty of variety, and a difficult, yet rewarding, challenge that's fun to unravel. ■ Phil Savage

Verdict

A great 2D platformer with procedurally generated levels and randomised loot.





SWITCH | \$79.95 | WWW.NINTENDO.COM.AU

apc
HOT PRODUCT

Splatoon 2

Splat's entertainment! Nintendo's speedy sequel makes another fine mess.

This follow-up to Nintendo's gleefully gungy shooter may feel familiar, as the original was released only a year ago. While *Splatoon 2* does suffer a little from second-man-in-space syndrome – a terrific feat, but less thrillingly new than the first launch – you'll quickly find yourself engrossed. Inkopolis, it's good to be back.

Seasoned players can leap in and know pretty much exactly what they're doing. But Wii U's sales woes surely mean plenty of newcomers will need bringing up to speed. If you haven't had the pleasure, *Splatoon* is a competitive multiplayer game where two groups of four Inklings (humanoid creatures that can assume squid form) battle over turf by spraying it with brightly-coloured ink. At the end of three minutes, the total area splatted is totted up and a winner declared. Fundamentally, little has

changed, but then there wasn't an awful lot to fix. Ink is thicker, shinier and gloopier, lightning has improved and everything looks sharper, brighter and altogether better. The plaza hub is sunnier and livelier, with more to do outside the online lobbies, and with menu shortcuts for those who aren't in the mood for mooching about.

There are eight maps at launch – two are repurposed versions of older maps – but Nintendo's planning to introduce more maps, weapons and gear in the months to come. Any quibbles about quantity are outweighed by the quality of these arenas. And with maps now being rotated every two hours rather than four, there's more chance of getting to play one of your favourites. The inability to quit lobbies or change your weapons while you wait, however, is still a pain, exacerbated by the fact you can't play arcade games

during matchmaking. These are the kind of quirks that are harder to forgive the second time.

There are few stage-specific gimmicks in the current batch of maps, though all have individual features that make them distinctive.

On weapons, there's little to beat the Splashdown, which sees an Inklings leap up and thump the ground with great force, splattering ink in a wide radius – combine it with a super jump into enemy territory and you've got a potential team-killer. It's one of a clutch of terrific new special weapons, including a powerful laser that can shoot through walls, a jetpack that lets you fire thick ink projectiles and our favourite: a translucent ball that can roll up walls, which you can manually detonate to take out nearby rivals. Or if you're feeling more altruistic, pick a set that gives your whole team

temporary armour, allowing them to withstand a single attack that would normally kill them.

Splatoon 2's campaign is a more confident, diverse offering this time around. The bosses range from a sentient oven that shoots out loaves of bread to a brute wielding a motorised roller while riding a unicycle. But while its difficulty curve is better judged than the original, the final encounter here is anticlimactic. You'll find plenty of excitement in the Horde-style co-op mode Salmon Run, however.

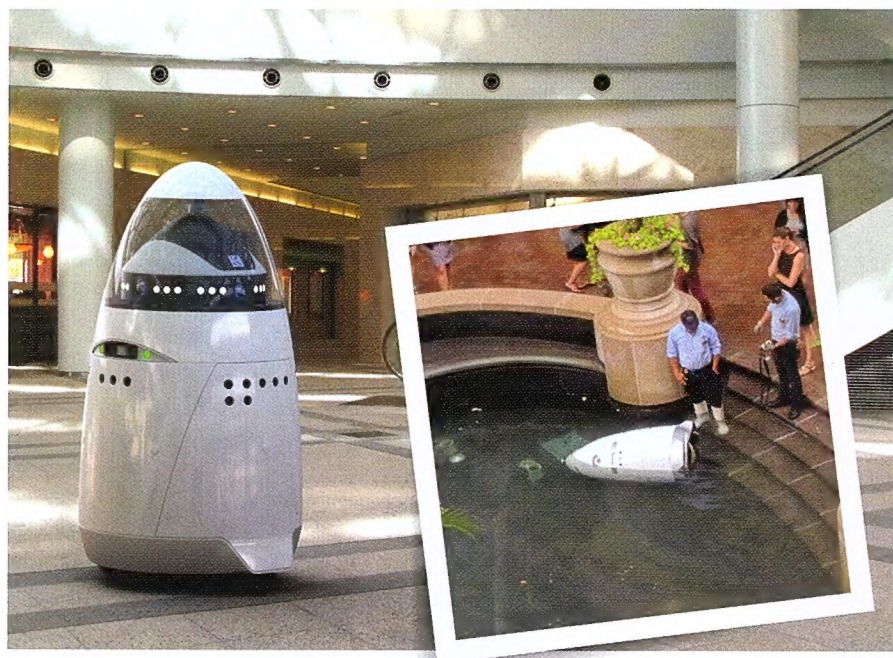
With an audience hungry for more of the same, this is a follow-up that delivers, with added polish.

■ Chris Schilling

Verdict

While this feels more like a makeover than a true sequel, it's still packed with squidding fun.





RIP, Steve

The security robot who drowned himself.

Steve the Knightscope K5 Autonomous Data Machine began his short career fighting crime as a patrol robot along the Washington Harbour on the 12th of July. Armed with multiple sensors (including anomaly and gun detection, forensic capabilities and 360° video streaming), the 136kg TicTac on wheels apparently failed to see the handful of stairs in his path and took a tumble into a fountain. Knightscope has said that Steve is in a "critical condition" and that there is no evidence that this is anything but an accident. He has been replaced by another K5. From all of us here at APC, we wish Steve a swift recovery.



Ocean's Fourteen?

FISH TANK LETS HACKERS INFILTRATE A CASINO.

A 'smart' fish tank has unwittingly become an exploitable weakness in a North American casino's security. Setting aside the obvious question for a moment ("What the hell is a smart fish tank?"), the hackers were apparently able to infiltrate the tank (digitally, obviously) and then send data to Finland. Using the fish tank as a doorway into the network, the hackers then "moved laterally to other places in the network" before being discovered and their attempt halted. The tank in question was connected to the internet so that the fish's food and water conditions could be monitored and controlled remotely.



Forget fingerprints or facial recognition...

GUYS CAN NOW SIGN IN WITH THEIR WIFE'S BEST FRIEND.

Get out your members, porn site members, because CamSoda wants you to get on board with its new 'Dick-ometrics' log-in process! Yes, that's right. If you've got a John Thomas, you'll soon be able to log in to your CamSoda account hands-free! According to the site, the pictures of your Johnson will be encrypted and, since your pocket rocket is as unique as a retina scan or fingerprint, it's a viable substitute identification method. At the time of writing, CamSoda has stated that its joystick recognition software is about 76% accurate, and actually relies upon the penile state of the Master Sword in question. In their own words, "girth, length, curve, vascularity are all affected by the level of arousal", so you'd have to do a bit of a warm-up first — which, in our humble opinion, kind of negates half the purpose of porn...

What's in a name?

AN AI HAS RENAMED THE ENTIRE UK!

Hatterford, Hale Town, Goldwater and Watcote all sound like places your humble viewer would put on her list of places to visit the next time she's in the UK. However, upon arriving in the country, she would be disappointed, because these places don't exist. They are, instead, the product of an AI that was trained to randomly generate British place names. The programmer responsible tasked himself with compiling a list of 50,000 real place names from across the UK and then input that information into a multilayered neural network. Of course, the AI didn't do this job flawlessly, coming up with place names such as Stabretch, Hall of urn-in Head, Barkton knan, Hoo The End, Hoshendodge and Stalkington. Creator Dan Hon, however, said that the results were "predictable" — even C*ckbeach and F*ckley.

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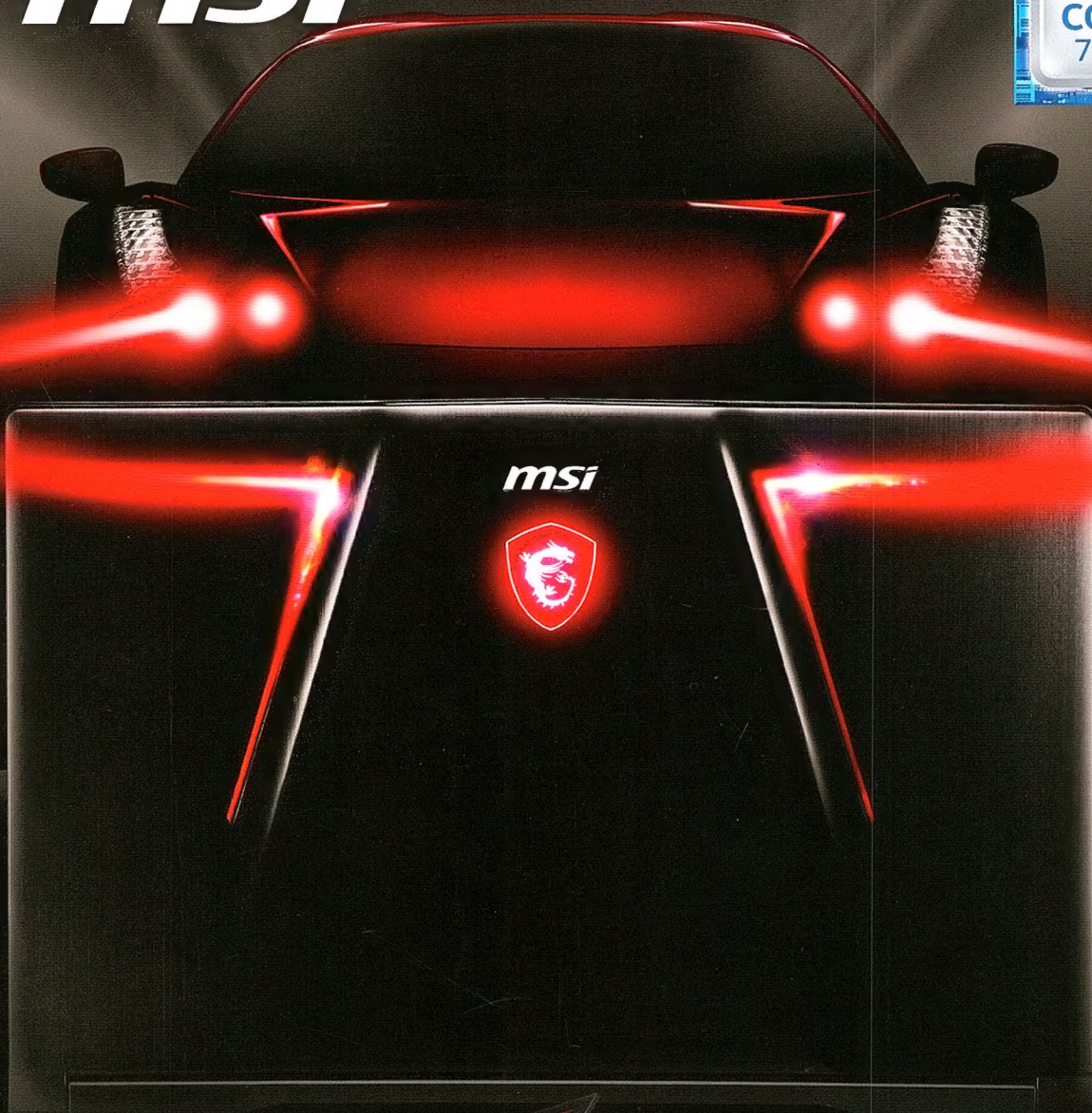
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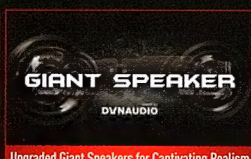
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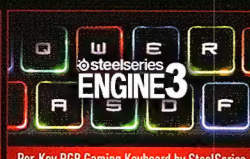
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